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Minister for Agriculture.

EDITED BY H. W. POTTS, F.C.S., F.L.S.

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DAIRYING BRANCH.

DAIRYING IN EUROPE.

By T. Cherry, M.D., M.S., Lecturer in Bacteriology, Melbourne University.

II.—Butter-making.

PURE CULTURE.

With regard to butter-making it must be remembered that the improvements in the general management and inspection of dairy herds, of the farms and of the factories which has been noted in connexion with the milk supply has of itself largely helped to place the practice of the butter factory on a different footing from that which it held before. Many of the farms and factories send their milk to the cities or make butter or cheese, according to the state of the market. It will be readily understood that when the milk supply has been placed in such a high state of efficiency the manufacture of butter is correspondingly raised. The technical knowledge acquired in the one industry may be at once applied to the details of the other. The ripening of cream is a special fermentation brought about by certain races of micro-organisms; during their growth they produce lactic acid. When only the one race of organism is present in the cream, the changes which take place are uniform and regular. When a number of different kinds of organisms are present they all flourish together, and the fermentation instead of being "pure" becomes mixed. The result is that a number of substances of uncertain chemical composition are formed, instead of the regular and uniform production of lactic acid. Butter made from cream ripened by a mixed fermentation may be good or it may be bad. Its character is quite uncertain. Hence the first requisite for good butter is a suitable fermentation; the ferment must act under well defined limits of temperature and for a definite length of time. When the desired limit of its action has been reached, the fact can be recognised by testing the amount of acid present in the cream. In all cases of fermentation, whether of cream, wine, or beer, it is of the greatest importance to have only one (and that the selected one) kind of micro-organism present so that the resulting fermentation may be as "pure" as possible. The single race of germs sown in any fluid to accomplish this object is called a "pure culture," and in the butter factory the material used for the sowing is known as a "starter."

From what has already been said about the germs present in milk under ordinary circumstances, it is evident that if left to itself a mixed fermentation would be set up in the cream. This is what is found to take place in practice. It often happens that a sufficient preponderance of the right kinds of bacteria are present to insure the production of good butter, yet, on the average, this result is just as uncertain as the

production of good beer when the fermentation of the malt and hops is left to chance. It will also be understood that when special care is taken to reduce the number of germs in the milk by more than ordinary care in the milking and subsequent handling, the ripening is much more likely to be satisfactory. Outside organisms might be so far reduced in numbers that a sowing of the desired ripener would have a clear field to itself and produce good butter. This method is successfully used in places where all the cows are under one control. But in practice the factory receives the milk from all the farmers of the district. One may be clean, the other careless. The milk or cream may vary in age by many hours or even several days. *To make good butter it is therefore essential to start with a pure culture as a ripener and to give it a clear field,* otherwise difficulties are sure to occur sooner or later. The clear field can be obtained by *pasteurizing the cream*—this kills off, practically, the whole of the germs present in it. The pure culture of the starter should then be added and it will produce the required fermentation, unhampered by the growth of any outside germs. This method is now adopted in 96 per cent. of the factories in Denmark. It is the sole cause of the uniform excellence of Danish butter, and it is looked upon as the first requisite of success. The advantages secured by this method are briefly as follows:—

1. The characteristic flavour is under complete control.
2. The butter is of uniform quality.
3. The butter is in the best possible condition for keeping.
4. It will, therefore, command a higher market price.

When butter has thus been made the vast majority of the organisms which it contains are the lactic acid bacteria which brought about the ripening of the cream. Others, however, are present, because a few always survive the pasteurizing, and others have got into it during the process of manufacture. Now, while the lactic acid bacteria multiply readily in cream, they do not do so to any extent in butter. Other varieties, whose development had been hitherto held in check, find favorable conditions for growth in the butter, especially if the butter-milk is not thoroughly removed, and begin to set up their own special series of changes. If their growth is not checked the butter becomes rancid or other changes ensue. Hence the importance of keeping the butter in cold storage. Such organisms may also have dropped from the air with particles of dust during the ripening, or have got into the butter from the churn or other machinery. Other sources of such germs are found in the water used in washing it, or the salt with which it is mixed. Of these the water is in all probability the chief source of contamination, especially in the country towards the end of summer. Rain water stored for several months in tanks is often bad from the bacteriological point of view, although it may look clear and bright. This will be understood by remembering that the dust from the roof is all washed down into the tank. Bird droppings and other particles of manure are nearly always present. While such

water may not be injurious to health, it is practically certain to contain some of the numerous kinds of germs which will grow in butter and make it go bad. Considering how cheaply germ-proof filters, capable of delivering 100 or more gallons of water in 24 hours, may now be purchased, I think it would be a wise precaution to filter all the water used in the factory, especially when the dry weather has set in. Rain tanks should also be regularly cleaned out. The cream room should be light and well ventilated; light, because the absence of daylight encourages the growth of moulds and other injurious micro-organisms. Its temperature should be under control, so that it may be maintained uniformly at about 68° F. Artificial heat and cold should both be available. Common sense also indicates that the site of a factory or dairy should not be selected in a haphazard way. It is better to cart the milk and butter a few hundred yards further in order to escape the dust of a road or stock-yard.

Methods of Cleansing.

It will thus be seen that successful manufacture involves, first of all, the proper ripening of the cream, and, secondly, scrupulous care in all the operations at the farm and factory. These requirements are more easily carried out if the factory is well designed and equipped, but no factory, however complete, will of itself make good butter. The first essential is knowledge on the part of the workman. An excellent example of a small model factory is seen at Tumba, an experimental farm belonging to the Separator Company of Stockholm. The site is carefully selected on the side of a hill, about 300 yards from the cow yards and other farm buildings. The prevailing winds blow from the factory to the farm. It is, therefore, out of the dust, and good surface drainage and easy disposal of waste water and skim milk are secured. The building is of brick and stone, the floors flagged with bitumen joints, the walls coated inside with adamantine, one of the smooth and impervious cements. Most of the machinery is in the main hall, nearly all the handling of the milk being replaced by methods of delivery by gravitation. For the most part the milk is first pasteurized, separated while hot, and then cooled. On one side of the main hall are the cool storage room, ripening room, chemical laboratory, bacteriological laboratory, and counting house. On the other side are the scullery, store-room, engine and boiler rooms, and bath-room. It may provoke a smile to know that all the employés are compelled to take a bath once a week, and enter up a note of the same in a book kept for the purpose. Arrangements are made not only for washing all the machinery and utensils, but also for sterilizing the parts which come in contact with the cream, milk, or butter. This is done 'y means of steam, which can be turned on so as to blow through the various delivery pipes of the milk and cream. Many modern factories have the delivery pipes as far as possible in the form of open gutters. These can be kept clean and sterilized more easily than ordinary closed pipes.

With regard to the sterilizing of such things as the separators, churns, workers, ripening vats, &c., the best and cheapest method is to

fill them with water containing ordinary washing soda, in the proportion of 1 lb. to 20 gallons, and turn the steam into it by means of a piece of hose until the water boils. This plan was discovered by Shimmelbusch in 1892; he introduced it for the purpose of sterilizing the surgeon's instruments before an operation. It is now very generally used by surgeons, and in the bacteriological laboratory we have learnt to rely implicitly upon it for all purposes. Not only are all known bacteria killed by momentary exposure to boiling soda solution, but their spores or seeds are also destroyed. These spores resist a heat which no other living animal or vegetable tissue can withstand. The advantages of using the soda in the factory are enhanced by the fact that it unites with the lactic acid present, forming a soluble lactate of soda, and also with the grease forming an easily soluble soap. It, therefore, accomplishes the double object of cleansing and sterilizing at the same time. Furthermore, it has the great advantage of not rusting or injuring any metal with which it comes in contact.

Milking Methods.

Another important matter, from the bacteriological point of view, is that all utensils and machinery, from the milk pail onwards, should be washed and sterilized immediately *after* use. When a few drops of milk or cream are left behind, the bacteria, which they are sure to contain, begin at once to multiply. In a few hours there are many thousands, or even millions, instead of a few hundreds; it is then not only more difficult to complete the cleaning, but, unless the boiling soda is used, a plentiful sowing will be present to begin growing in the next fluid which is put into the utensil. This is the reason why skim milk turns sour so quickly when emptied into the pig's barrel, and it also explains much of the difficulty of bringing up infants on the bottle. The barrel and the bottle are alike in this respect, that they are both seldom effectively cleaned. The amount which is left behind may be so small that it is not observed by the eye, but it is quite sufficient to enable the tiny germs to get a foothold and to grow. Trouble is saved by never putting away a dirty utensil.

The means of contamination of the cream by dirty buildings and machinery are important, but the contamination of the milk by careless milking is equally important. The method which is too frequently seen of taking a little water in the milk pail in order to wash the udder of the cow is almost worse than useless. The hands and dress of the milker, the udder, and the milk pail all require to be clean. By taking sufficient care over the matter it is possible to get the milk nearly free from germs, and such milk will keep sweet as long as ordinary pasteurized milk. But in practice the best results are got by having one of the farm hands to go round and wash and dry the udders just before the milkers. In well-managed farms clean white uniforms are worn by the milkers in the same way as by the workmen at the factories. The uniform itself may be a matter of small importance, but it impresses the value of cleanliness upon the workman. The regular grooming of the cows and the cleanliness of the bedding and buildings are points

which bear directly upon the production of good butter, but they are outside the scope of this report. Airiness and ventilation are, however, just as important in the farm buildings as in the butter factory, some authorities going so far as to recommend milking in the open air during fine weather. The sources of contamination of the milk are, however, very numerous and varied. It is clear that satisfactory results can be obtained rather by constant attention to minute details than by the adoption of any single expedient at one particular stage of the work.

Feeding Calves.

A practical demonstration of the real value of precautions similar to those described above is seen in the ease with which calves may be reared on pasteurized skim milk. My attention was drawn to this at several of the experimental stations both in England and on the Continent. The chemical composition of the food is made right by replacing the cream with linseed or other fatty constituent. The bacteriological requirements are met by pasteurizing the milk, and feeding it from a clean artificial udder. This consists simply of a copper basin to which is attached an indiarubber teat on the end of a tap. Any kind of can will do equally well. The important point is that the "udder" is sterilized by scalding immediately after use. Micro-organisms injurious to digestion are thus kept out of the calf's stomach, and the old troubles such as scouring, &c., are never seen. Object lessons of this kind show the practical application of scientific principles. The experimental research which has taught us the importance of bacterial processes has been carried out on a small scale in the laboratory. The principles once established may be turned to account in matters of every-day life on any required scale. When these principles are once firmly grasped by the workmen they readily understand the importance of their application to matters of detail.

Danish System of Competitive Examinations.

The centre where most of the scientific work in connexion with the dairy industry is carried out is the laboratory of Professor Storch, in the Veterinary and Agricultural High School, Copenhagen. This institution is brought into immediate relation with the producer by a system of examination of the butter, which is constantly going on. Any farmer, factory, or factory manager may join the laboratory, as a voluntary act, so as to secure the benefit arising from the quarterly State butter shows. A special building is provided by the Government, for which a grant of £1,000 was made. A sum of £1,350 is voted annually to defray current expenses. About 900 factories take advantage of the system. Thirty of the large butter dealers act as judges together with the dairy experts appointed by the State, and they have the assistance of Professors Storch and Bang, of the Bacteriological and Chemical Laboratories. The factory manager or dairyman is called on by telegram to send a tub of butter on a fixed day. The manufacturer is unable to make a special cask, but is compelled to send one of that day's make; and thus a sample of the factory's ordinary produce is

secured. This is examined on arrival and weighed by the judges; it is kept for fourteen days and re-examined, and reports submitted, giving the results of bacteriological and chemical examinations. Small cash prizes are awarded to the makers of the best butters. A scale of points is adopted; and if a manufacturer consistently maintains a high standard, he is granted a certificate at the end of three years. This diploma is the blue ribbon of the trade, and necessarily it stimulates a spirit of healthy rivalry, which re-acts in a commercial way on the success of the factory. Should faults be found during judging, these are recorded, and the manufacturer informed in a useful report, and the remedies pointed out. Should he fail to improve at the following contest, an expert is sent to the factory to personally investigate the conditions affecting the quality, and rectify them.

These regular exhibitions, combined with scientific aid, have contributed largely towards securing a high uniform standard of the product. These State butter shows were organized by the late Professor Fjord in December, 1888, and now all the leading factories are reaping the benefit of the continuous and practical form of technical education. The Laboratory for Agricultural Research was also organized by that talented professor. After his death M. Früz was appointed his successor, but most of the work is still carried out on the original lines. The laboratory contains five distinct departments, as follows:—

A. Ambulatory experiments on farms, conducted by assistants sent from the laboratory, to which primary results and samples are to be dealt with, and recorded in several reports. Only purely practical questions are dealt with in this department. The experiments are of four different kinds—

1. Feeding experiments with milch cows, with a view to determine the influence of different sorts of fodder on the amount of milk and its contents of fat. These have been carried on for thirteen years on twelve farms or estates, with from 30 to 50 cows on each farm every year.
2. Feeding experiments with pigs, to show the influence of various feeding materials on the amount and quality of bacon. These are conducted on 25 different farms with several thousand pigs.
3. Dairy experiments, to solve such questions as the influence of pasteurizing milk, the influence of various feeding materials on the quality of butter.
4. Experiments to show the composition of milk from individual cows, both as regards quantity and quality. These are carried out on 27 farms with about 3,000 cows.

B. The Chemical Laboratory, under the direction of Professor Storch, for the analysis of samples of feeding stuffs, butter, &c., for independent chemical investigations of practical and scientific interest and relating to the above experiments.

C. The Bacteriological Laboratory is controlled by Professor Bang, M.D. Here are conducted examinations into the causes of various animal diseases and the means of checking them, particularly tuberculosis. Tuberculin is prepared in large quantities, partly for use in the laboratory and partly for distribution to veterinary surgeons throughout the country. The State assists in this. Investigations are conducted in all phases of the dairying industry.

D. The Laboratory for Animal Physiology is under the direction of L. V. Henriques, M.D., partly for purely scientific purposes, and partly for clearing up certain questions relating to experiments mentioned under A.

E. State butter shows already described.

A professorship in dairying was established at this college as early as 1874.

All factory managers have to undergo a complete course of instruction, practical and scientific, at the Dairy College, and are granted certificates on passing a suitable examination.

III.—Fishiness in Butter.

While in London, through the good offices of Mr. Sinclair, a number of samples of butter were obtained direct from the cellars of the brokers. From a number of those which were found to be fishy, I made cultures of the micro-organisms present, and brought these with me to Melbourne for the purposes of further investigation. I also had placed in the refrigerator of the steamer by which I returned to Australia a number of samples of Victorian butter, both sound and fishy, and also specimens of Danish, Normandy, and German butters, to see how these will stand the journey. Before mentioning the results attained from these investigations, it may be as well to draw attention to one or two facts with regard to fishiness and other matters connected with the handling of Victorian butter in London, which are, perhaps, worth recording.

In the first place, no exact record is kept of the numbers of boxes in any given shipment which are affected. Hence, precise information, the most important thing in an inquiry of this kind, is not available. All the information obtainable from the brokers is more or less guesswork; most of them say that on the whole the average quality of the Victorian butter is improving; one or two think there is more fishiness than ever. The most significant fact I was able to gather was the definite statement that in the season 1898–99, one of the western district factories sent its butter in two forms, one made from pasteurized cream, the other from non-pasteurized. The former never went fishy, the latter did. Experiments of this kind might easily be repeated by any company; the two parts of a shipment require to be prepared and packed precisely the same in all respects, the only difference being that the cream is pasteurized and ripened by means of a pure culture starter in the one case but not in the other. Valuable information could also be obtained by extending the scope of the inquiries made by the representative of the Department of Agriculture in London. Arrangements might be made to obtain particulars from the brokers of any butter

reported as fishy. On receipt of those reports in Melbourne, inquiry could be made at the factory as to the details of its manufacture and shipment. There would be no need to publish these reports to the public, but they would enable the experts of the Department to come to definite conclusions about fishiness and other defects in the course of a season or two.

The peculiar odour and taste of "fishy" butter are due to the presence of trimethylamine or other volatile bodies of somewhat similar chemical composition. Trimethylamine was first of all discovered in herring brine, and it is the substance to which this fluid owes its distinctive flavour. It is a product of fermentation or decomposition, that is, it is due to the action of micro-organisms of some kind. But at the same time it is not exclusively the product of any single species of micro-organisms. About twenty kinds are known to have the power of producing this flavour, and these have been found not only in herring brine, but also in the dust and in ordinary water. The fishy flavour is not often perceptible in the butter in London as soon as it is landed from the ship. It develops gradually after it has been a day or two out of the cold storage. All those interested in the trade agree as to the fact, that it is distributed in any given shipment in the most irregular and puzzling way. Of the boxes sent from the same factory one or two may be affected, while all the others escape, and it is very rare for it to be distributed in such a way as to suggest any simple explanation for the fact. No wide-reaching course, such as the herbage on which the cows feed, can be admitted as a likely cause. It is not due, at all events exclusively, to the salt, because unsalted butter sometimes becomes fishy, as also does cream, and occasionally even milk.

Turning now to the direct bacteriological evidence, I have examined the cultures and specimens of fishy butter obtained in London, and also a number of samples of similar butter which have been sent to the laboratory from factories in Victoria. In all these cases it has been found that we are dealing with a mixture of species of micro-organisms; that there is no one kind which preponderates to such a degree as to suggest it as the sole cause of fishiness. Moreover, fishiness cannot be produced from pure butter-fat and milk sugar. The material from which the organisms produce it is the butter-milk or curd; in other words, it is a product of the putrefactive changes occurring in proteid substances. Some of the trimethylamine organisms grow slowly at comparatively low temperatures, only a few degrees above the freezing point. This is suggestive as explaining the development of the flavour soon after the butter leaves the refrigerator. A somewhat similar phenomenon is seen in the case of meat which has been "chilled" but not frozen hard. It often acquires, after two or three weeks a peculiar disagreeable taste and smell; and meat which has been frozen hard for some weeks and then allowed to thaw, soon acquires the same taste, even if it is still kept at temperatures only slightly above freezing point. This peculiar change appears to me to be precisely analogous to the fishiness in butter. It is not due to one special kind of organism, but

is the joint result of the action of many kinds, which agree in being able to grow at very low temperatures. The vast majority of ordinary putrefactive bacteria grow very slowly at temperatures below 45° F., although the degree of cold which is necessary to bring their growth to a stand-still varies almost for each separate species.

Besides the undoubted fact that cream occasionally becomes fishy, there is another consideration which seems to point to the case being a complex one, rather than simply being due to one single species of bacteria. This is the history of the Dutch butter in the London market. Some years ago fishiness was so common in it that considerable shipments had to be sent back unsold, there was no market whatever for them in London. It will be remembered that this fishiness developed rapidly, the butter being sold in London within a week of the time that it left the farm in Holland. Now, however, it is much less common in Dutch butter, the apparent cause of the improvement being, not the adoption of any single method of manufacture, but improved methods throughout the dairy and factory generally. This advance is due to the competition of the different competitors for the London market. The steady improvement in the quality of the Danish butter has compelled all other countries to keep pace, or else lose their hold on the market. A *single* species of organism would hardly disappear from the *whole* of Holland simply as the result of improvements in *general* methods. We would expect it to cling tenaciously to some particular districts. Again, the experience of Danish butter points strongly in the same direction. This butter never goes fishy in London before it is sold, that is within a fortnight or so of the time of its manufacture. The cause assigned for this fact is the universal adoption of pasteurization, and the use of pure cultures as starters. Otherwise why should not fishiness appear in Danish as well as in Dutch, Australian, Canadian, and indeed all other butters?

Assuming, then, that fishiness is caused by a variety of organisms, most of which grow slowly at temperatures a little above the freezing point, it will be seen that these organisms may gain entrance to the milk, to the cream, or to the butter, at any stage of manufacture. It is quite probable, from what is known of organisms which produce trimethylamine, that they may sometimes come from the water or the salt. If, then, they have such various origins the success of pasteurization of the cream is at once explained. For, as has already been pointed out in connexion with the milk supply and butter making, pasteurization destroys nearly the whole of the organisms present in the mik or cream, and gives the useful bacteria a clean field for their own development. Whatever may have been the source of the germs in the milk pasteurization is the effective method known for dealing with them. But while pasteurization may destroy the germs it has not the power of reversing the chemical changes which have already taken place as the result of their growth. It will not turn sour milk into sweet, or restore over-ripe cream to the condition proper for churning. Hence the necessity for dealing promptly with milk and cream, especially in hot weather. In Denmark this difficulty does not

exist, because there is a factory every mile or two, and the Danish farmer has an unlimited supply of ice. He fills a cellar with it in the winter, and uses it liberally in the summer. With our scattered farmers the problem is, how to secure the delivery of the milk or cream within two or three hours of milking. It seems to me that this can only be done by multiplying the creameries, establishing these for each district, and if necessary, at some central farm, the owner of which will run the separator and pasteurizer, and send the cream at once to the factory. Returning from the factory he should bring back ice for the next day's operations. Such a system would of course increase the expenses, but it would also increase the value of the butter by raising its quality generally and preventing fishiness in particular. There should be no objection to the home separator, provided the cream was promptly delivered at the creamery, pasteurized at once, and then kept cool. Moreover, the additional expense of such a system would be more apparent than real. The factories would undoubtedly have to employ more men, but, on the other hand, every milk supplier would save time by having to cart his produce on the average a much shorter distance. One chief reason for emphasis on this point is the fact that it is more difficult to make good butter in a warm climate than in the cool countries of northern Europe. With the warmth all processes concerned in fermentation are much more active and difficult to control. This difficulty will be understood by remembering how much more quickly milk goes sour in summer than in winter. Consequently, in order to place us on an equality with the Danes our methods of manufacture must be not only equal to theirs but better. For we have not only the less favorable climate to contend against, but we have also to ship our produce to the other side of the world. The voyage from Denmark to London is about the same length as that from Sydney to Melbourne. But to educate our producers up to the highest practicable standard is a slow process, requiring steady and persevering effort. To bring the creameries within the reach of all, so that the cream may be secured before it is spoilt, is the most important step in the direction of producing good and uniform butter.

Summary of Report.

A.—General Recommendations.

1. Children should learn the general principles underlying fermentation by means of experiments performed by themselves in the State schools. These should form part of a course of experimental science. By this means the workmen would be educated to understand the difficulties to be overcome in butter-making and similar industries.

2. The factories should be situated in the country, in sites carefully chosen, especially with regard to dust and drainage. It is much more difficult to make good butter at a distance from the producer.

3. Multiply the creameries.

4. Pasteurize all creams while perfectly fresh, and ripen by means of a pure culture as a starter.

5. Sterilize all farm and factory utensils and machinery at once after use by means of a boiling solution of soda ($\frac{1}{2}$ per cent.).

6. Cold storage requires to be freely available. Fermentation changes may be stopped, but they cannot be reversed by cold.

7. The cream ripening room to be well lighted and ventilated, and its temperature under complete control.

8. The water supply of a factory should be regularly examined, and, if necessary, passed through a germ-proof filter in order to secure its purity.

9. A bath-room and arrangements for clean working uniforms should be provided at every factory and creamery.

10. Definite instructions as to the details of methods of manufacture, &c., can be best arrived at as the results of experiments on a comparatively small scale.

B.—As to Fishiness.

1. The information with regard to fishiness obtainable from the London brokers is extremely vague. Most of them say that the average quality of Victorian butter is improving. One or two think there is more fishiness than ever. No record appears to be kept.

2. At the time I was in London fishy butter was not common. I had to go to some brokers two or three times before I could get a sample, and in some cases I could not get a sample at all.

3. "Fishiness" is a general term, applied in the trade to butters which smell of other things than trimethylamine.

4. True fishiness is probably due to trimethylamine, or some allied body; chemical substances known to be the products of a number of different putrefactive micro-organisms.

5. What reliable evidence could be obtained in London goes to show that it is prevented by pasteurizing the cream, and by extra care in manufacturing the butter.

6. Bacteriological research has so far failed to discover any single kind of organism as the special cause of fishiness. It is probable, therefore, that improper methods of handling the milk, cream, or butter, at any stage of the process of manufacture will cause this defect.

7. Fishiness is specially liable to occur in butter from which the butter-milk has not been thoroughly removed in the working.

DAIRY BACTERIOLOGY; OR, GERM LIFE IN RELATION TO OUR DAIRYING INDUSTRY.

A Lecture given to State School Teachers at the Summer School, Training College, Melbourne, January, 1902.

By H. W. Potts.

Bacteriology is one of the youngest sciences, and although its history dates back to the researches of that eminent Dutch philosopher, Anton Leeuwenhoek, in the latter part of the seventeenth century, yet its real significance is a matter of modern discovery. It now occupies a prominent place in the laboratories of pathologists, chemists, brewers, agriculturists, dairymen, tobacco manufacturers, tanners, and others.

It was not until the middle of the nineteenth century that it was thought that these lower forms of plant-life had any relationship to decomposition or changes in organic products, and termed fermentations, or that bacteria possessed any influence in the cause or progress of disease. It was a startling awakening to modern scientists when the eminent chemist, Louis Pasteur, as a result of his classic researches, boldly announced in 1860, "no fermentation without germ life." His earliest researches were directed to the causes of the souring of milk. Robert Koch contributed a lasting stimulus to the science of bacteriology in 1882 by the discovery of the bacillus of tuberculosis, the cause of consumption. England's greatest surgeon, Baron Lister, frankly acknowledges his indebtedness to Pasteur for guiding him to the discovery of that inestimable boon, antiseptic surgery, through which the practice of modern surgery has been revolutionized, and thousands of lives saved.

Owing to the prominence given to bacteriology in its application to medicine and surgery, an impression prevails that micro-organisms are only of interest to the physician or surgeon. The army of earnest investigators engaged in elucidating the life-history of germs, however shows that they are omnipresent, and take part in incalculable ways in controlling and directing natural phenomena.

Germs are found in air, water, soil, and rocks. We know now that without their agency this earth's surface would be uninhabitable.

Closely associated with these minute and invisible microscopic plants are moulds and yeasts.

The Useful Organisms.

For simple classification we may divide micro-organisms, germs, bacteria, or microbes into four leading groups; the first to include the useful families and their application to industrial life.

From the very dawn of history we know that yeast, or the leaven of Scripture, was used to add to flour in bread-making. In isolating and propagating the useful forms of organisms, our object—in

manufactures where fermentative processes exercise a beneficent and controlling influence—is to promote the increase of the desirable varieties, thereby to enhance the value of the finished product; and to eliminate or destroy the antagonistic or harmful organisms.

This is especially valuable in the manufacture of wines, beers, and other beverages in which correct fermentative changes are generated by selected cultures or families of organisms. Similar results in developing agreeable and palatable flavour and aroma are obtained in the manufacture of butter by inoculating the cream with selected varieties of bacteria. In many chemical industries, bacteria exert an important influence, such as in the making of vinegar, the tanning of leather, the flavouring of tobacco, the ripening of fruits, "retting" in the linen and jute trades, the curing of opium, and the manufacture of indigo. *The growth of higher plant life in all its forms is* indebted to micro-organisms. They reduce manures to a condition in which they can be utilized by crops. They transmit nitrogen from the atmosphere to the root of the plant; and the application of bacteria in agricultural processes is of unlimited benefit. Every step on the farm is associated with bacterial life. A change is surely taking place in our methods of culture as a result of recent knowledge in bacteriology.

Putrefactive Organisms.

The second group includes the putrefactive series of bacteria. These are of hygienic value, and are nature's scavengers. All the chemical elements indispensable to life are set free through the agency of these organisms. They attack all lifeless remains of plants and animals and reduce them to simple elements, which serve as manure or food for new life. When a cabbage leaf falls to the ground decomposition is started by bacteria, and the remains are returned to the soil to nourish it. All life on the surface of this earth would cease without this wonderful process continuously being performed by microbes. Change, putrefaction, and decay are noted in other instances: when meat goes bad, milk sours, butter becomes rancid, eggs are uneatable, and wood rots, we know that hostile organisms are at work; as they are also when organic matter, whether solid or in solution, decays, becomes foul, spoils, rots, sours, putrefies, becomes mouldy, ferments, or produces nauseous compounds. Where the putrefactive micro-organisms gain the ascendency in fermentative processes they falsify the desirable results, such as flavour, and interfere with the functions of useful organisms.

Disease-producing Bacteria.

The third group embraces the pathogenic or disease-producing organisms. This large and formidable section is responsible for such diseases as consumption, small-pox, diphtheria, typhoid fever, measles, bubonic plague, anthrax, &c. The saving of human life through the recent knowledge acquired from this science is beyond all calculation.

The Unknown Families.

In the last section we include the unknown families of bacteria. We are cognizant that there are numberless species of organisms distributed throughout the universe whose identity and functions remain to be investigated. So far, only about 700 species have been isolated, named, and their life-histories and characteristics recorded.

Bacteria Described.

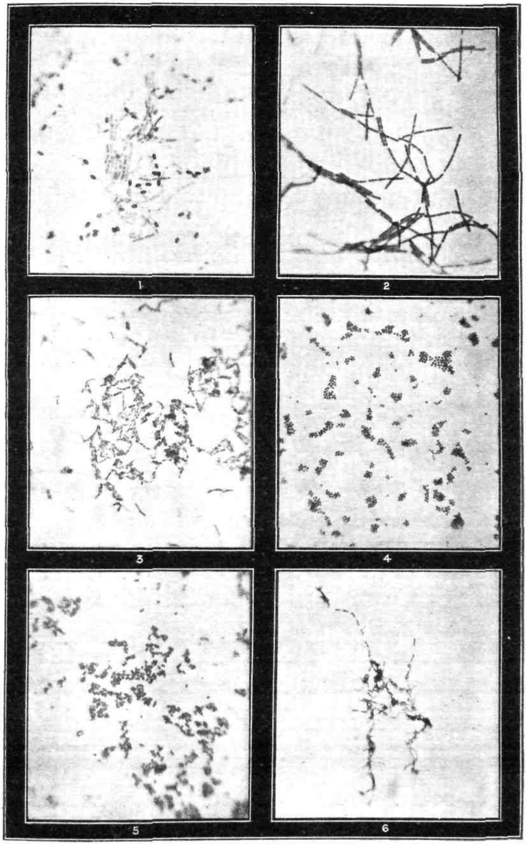
Bacteria are the simplest forms of microscopic plants, consisting of single transparent cells, and so small that they can only be seen by the aid of a powerful microscope. They absorb nutriment, grow rapidly, and reproduce their species ; in fact, follow the same laws of existence as the higher plants.

In form they present marked variation, but there are three leading varieties. They may be round or spherical, like a bead, marble, or billiard ball. This type is called a micrococcus. Another familiar form is rod-shaped, cylindrical, or like a lead pencil, and is known as a bacillus ; and the other shape is like a corkscrew, spiral in form, and named spirillum.

How they Multiply.

Organisms have to be surrounded with special conditions to propagate, such as suitable temperature, food, and moisture; and, given these, it is wonderful to learn of the rapid manner in which these cells or germs multiply. The rod-shaped cell or bacillus reproduces its kind. It grows rapidly, and on attaining adult size it multiplies in a most simple manner by dividing in the middle into two equal parts, each of which becomes a distinct cell. Thus we have two cells from one parent cell. This process, known as fission, progresses, and with suitable conditions for growth goes on until the food is exhausted or they surround themselves with the waste products from their own bodies, and this checks the increase. A rod has been known to divide in half-an-hour. At this rate of increase, one cell or germ in 24 hours will become 17,000,000. Other forms or varieties propagate by means of spores or seeds. All germs must have food to build up their bodies; digestive changes take place, and they excrete or throw off certain chemical substances. They are engaged in effecting distinct changes, and a knowledge of these renders their application to industrial processes of immense value.

(*To be continued.*)



1. Anthrax with Spores.

2. Anthrax.

3. Diphtheria.

4. Micrococci.

5. Lactic Acid Bacilli.

6. Bacilli in Chains.

CREAM TESTING.

Disputes concerning the proper test of cream will never cease until all samples are weighed instead of measured. Measuring cream with the pipette is merely guessing, and very poor guessing at that, as the amount delivered by the pipette will vary several per cent. according to the richness and degree of ripeness of the cream measured.

Any attempt to correct the error by varying the amount taken is only making matters worse, and adding to the uncertainty of the cream test.

For the test weigh out 6, 9, or 18 grams, and then the result can be depended on to be accurate. In case less than 18 grams of cream is taken, add sufficient water to bring up the volume to 17·6 c. c., then add the regular amount of acid and proceed as in testing milk.

—*Hoard's Dairyman.*

THE WANT OF SUFFICIENT REFRIGERATING POWER IN BUTTER FACTORIES.

By R. J. Carroll, Dairy Supervisor.

The above want appears to me to be a very important matter in a number of butter factories at the present time.

On my visits to the various factories I find it invariably the case that the refrigerators in use are either too small to cope with the output in very hot weather, or just sufficiently powerful to do the work of each day in from twelve to sixteen hours.

This is all very well while the machinery does its work well, but should a breakdown occur a serious loss must take place, both in the quantity and quality of the butter manufactured. In a few instances that came directly under my notice I sampled and tested the butter-milk, and found it to contain from 2·5 to 4· of butter-fat, which meant a loss of 27 lbs. of butter daily to No. 1 factory, and to No. 2, which had a much larger turn-over, about £8 sterling per day. This may appear a very large sum, but it is, nevertheless, correct. Should any butter factory manager doubt the correctness of it let him try for himself, either by testing his butter-milk for a week, or running it through the separator.

Directors of butter factories would do well to take into consideration whether it is advisable to risk this loss every time an exceptionally hot week is encountered, by using a machine of insufficient cooling power to deal with the output.

Another means by which a serious loss might be incurred is the inferiority of the butter made from cream churned at a too high temperature, or that which has been improperly cooled.

It is only necessary to visit the sale-rooms in Melbourne during the export season to see large consignments of butter coming to hand from some of the country factories bearing no visible brand (this in itself is proof that the quality is not up to the usual standard), and sold on the open market, because it is not considered fit to export and to bear the company's registered brand. Why is this? Simply because there is not a cooling plant of sufficient capacity in the factory to properly treat the cream. I would like to point out to factory directors that every season put over them in the butter factory under such conditions means a loss of the cost of the extra refrigerating power required without putting themselves in any better position to deal with the next season's output.

In the handling of private separator cream, or cream from long-distance creameries, the need for prompt cooling is essential. I have on many occasions found such cream on arrival at the factory in very hot weather to contain sufficient acidity for churning, but owing to the want of adequate refrigerating power to cool or treat immediately, the manager was compelled to leave it over till next day, or perhaps longer, before the

desired temperature was reached. It is needless to say that it was then *beyond the stage at which it was possible to convert it into good butter.*

It is a well-known fact that cream received in a ripe state at a high temperature, and allowed to go through a slow process of cooling in cans or vats for 12 to 24 hours, must be completely spoilt and unfit to make a good keeping butter.

While dealing with this portion of the subject, I might mention that I have recommended factory managers treating this class of cream the immediate cooling of same to a temperature of 50° F., and churning at once if practicable, otherwise it may be allowed to stand till next day after cooling without any appreciable change. This plan has been adopted by a few managers who were fortunate in having ample freezing power, and has given entire satisfaction by enabling them to make a good-quality butter from private separator cream, which would otherwise have been spoilt, were they not in a position to cool and treat it immediately.

Assuming that by a struggle you get your cream to a temperature before churning that will give the best results: you must then provide cool water for washing the butter. This is not available in every factory, and how is it to be procured if the cooling power at your disposal is not large enough. The consequence is, the butter has to be washed with water ranging from 60° to 70° F. As a result of this the grain of the butter is spoilt, and perhaps the flavour also, and the greater portion of the work of the previous day undone. In the butter-making room, again, we require refrigeration, and how many factories have any provision for cooling the room they make the butter in, which in hot weather may reach 90° F. Now, what butter-maker could guarantee to turn out butter of good texture under such conditions, besides the injury done to the flavour and keeping qualities due to exposure in a temperature so favorable to the growth of germ life?

Last, but not least, is the importance of having a cool-room for placing the butter after boxing, to chill before consigning; especially is this so where the butter has to be carted long distances to the railway stations. In some factories I have seen the butter standing in boxes in the butter-making room, at a temperature of from 70° to 90° F. This state of affairs exists some time or other in factories where the refrigerating power is inadequate. The manager's first call is his cream, and until that is sufficiently cooled no attention can be given to the cooling of butter.

Refrigeration plays a very important part in the manufacture of butter. After separating, every subsequent process has to be accompanied by refrigeration until it is placed on the consumer's table.

As an illustration of the necessity for cold storage to enable us to place our butter on the foreign markets, I need only refer you to the costly buildings and plant at Flinders-street, or the expensive fittings in the ocean liners that carry our produce, all for the purpose of controlling and maintaining temperatures.

Now, if all this is necessary for transit purposes, how much more necessary must it be in the factory, where the raw material is received and manufactured.

If low temperatures are required (and we admit they are) to convey our butter from Melbourne to London, are they not also very necessary during the time the butter remains at the factory, in order to retain that natural flavour and aroma which is the great essential of good butter.

Before concluding, I would urge butter factory directors to take heed when they are informed by their manager that the freezing power is deficient, as the difference between defective and proper refrigeration may mean the difference between a profit and a loss to the company. Managers are not always prepared to publicly admit that a serious loss has taken place owing to insufficient refrigeration, as some unscrupulous person may make use of that statement to reflect on his reputation, attribute the cause to his incompetency, and perhaps bring about his dismissal.

MILKING TUBES.

By R. T. Archer, Dairy Supervisor.

Milking, although not heavy work, is very tedious, and every one engaged in it is imbued with a desire to get through the operation as quickly as possible, and to this end sometimes adopt very unwise methods; and my object in writing this is to warn any one who may be inclined to adopt the method of syphoning the milk out of the teat by means of tubes of various kinds, whether of quill, metal, vulcanite, or any other material.

In the first place, any artificial method of milking, to be successful, must imitate the action of Nature as nearly as possible, and that cannot be claimed for any process where anything has to be inserted into the milk duct. The lining membrane of the teat is very delicate and tender, and the slightest roughness on the instrument used will tear it, and leave it in a suitable condition for the reception of septic or other germs, which set up local inflammation, or irritation, with very frequent loss of a quarter, which, needless to say, reduces the value of the cow very considerably. I heard of a farmer in South Gippsland who was milking his cows with the aid of silver-plated tubes or syphons, the end of which is inserted into a rubber tube, and runs into the bucket, one to each teat. It was found that when tubes were used to each teat the cows very often sulked, and did not let their milk down so freely as if the two front teats were milked by hand, while tubes ran off the milk from the hind teats, and in some cases they would scarcely give down any milk. Then, again, they found that in the case of heifers on their first calf the teats appeared to be too tender, and several had their quarters destroyed.

In the case of cows that were hard to milk, owing to the sphincter muscle being too tight, it was found that the tubes had the effect of causing a warty growth in the teat, and made them worse than ever. In the case of old cows they could not see that any ill effect resulted from the use of the tubes.

I determined to investigate the matter further, and wrote to Mr. Williams, of Kongwak, as I heard he had been using them. He replied as follows:—"My opinion is they are bad for the cows. I have thrown them all out. I used them, or rather all our milkers used them, for about three months, each milker using two tubes, and milking the other two teats by hand. For the first month I was delighted with them, and recommended them to several people, as we were able to get over the work in 20 per cent. less time, and they were especially helpful with tough cows. The tubes made some of th cows teats a bit sore. This I thought would wear off, but instead of getting better they got worse, and a scab formed over end of teat, which had to be removed every time; also, in a good many cases, a kind of warty growth formed in the teat, which made it nearly impossible to milk them without tubes. This was especially the case with heifers. I have had to turn out five heifers altogether because they got so tough, and

even too sore for the tubes, and have got five or six blind quarters to boot, so that I am clean off them." This is Mr. Williams' opinion after three months' trial, and he came to the conclusion that it was a costly experiment. Others who have tried them had the same experience as Mr. Williams.

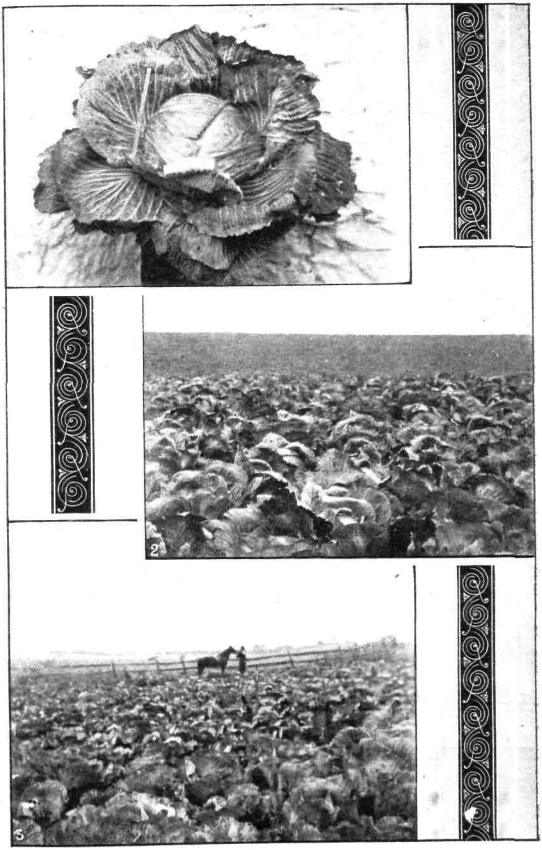
The tubes are very useful and entirely satisfactory when used for the purpose for which they are intended, viz., to relieve the udder in extreme and urgent cases; and then great care should be taken to have them sterilized by boiling them in water, and immersing in a solution of boric acid or permanganate of potash.

DRUM-HEAD CABBAGE FOR DAIRY CATTLE.

No food is more keenly relished by dairy cattle than cabbage, and this is readily understood when we know that it affords a succulent green food at a season of the year when pastures are dry and green fodder is very scarce. The value of this class of forage has been fully recognised and appreciated in several parts of the State since the introduction of our present system of dairying, but in no district is the regular production of cabbage for dairy cattle more profitably conducted than at Port Fairy. Here the climate, soil, and other conditions seem eminently suitable to the growth of this plant, and what is probably of equal importance is, that the local growers have made a special study of it, and how to bring its growth to a high state of development by suitable methods of cultivation. It is often shown, where the cabbage is planted in rich ground, that the total yield per acre will equal, or even exceed, that obtained from the best root crops. As a food for milking cows it is nutritious, containing from 11 to 12 per cent. of solid digestible matter, and, in comparison with turnips, the feeding value is about double.

The question is often raised that cabbage will taint the milk, but a long experience by such well-known dairymen as the late Mr. John Goldie and Messrs. Steele Bros., of Port Fairy, disprove any such suggestion. It is only when decayed, brown, or decomposed leaves are allowed to form part of the ration that any trace of taint can be detected in the milk. Further, it comes in at a period when succulent, nourishing food is mostly required to maintain the full volume of milk flow. Mr. William Goldie, of Port Fairy, has been good enough to supply the following particulars of the methods pursued for several years past by himself and his late father. He states :—" The first operation is to select a nice, well sheltered, and early piece of ground, for preference in a garden, in the month of July. Prepare it by digging and work the surface down smoothly. At the end of the month sow the seed of the drum-head cabbage in rows about 1 foot apart, and, to stimulate the growth of vigorous and sturdy plants, it is a good plan to sprinkle in a pound of nitrate of soda to every square perch or rod. A plot of 2 perches square will be sufficient on which to raise enough cabbage plants for one acre of ground. The plants should be kept free from weeds. At the end of September or early part of October they ought to be ready to plant out. Next select a plot of moist ground which has been well cultivated and manured either with about 30 tons of good farm-yard manure per acre or a fertilizer specially suited for this class of fodder. In our district experience has taught us that 1 cwt. each of nitrate of soda and concentrated superphosphate per acre, well mixed first, sown on top and harrowed in provides the best returns. If farm-yard manure be used, that must be ploughed in. Harrow and roll the ground work out in lines—a Planet Junior will be found very convenient—wide enough apart to allow a horse hoe to be worked. As a rule, 2 feet is sufficient. When the ground

has been prepared select a dull or, better still, a light showery day for planting. In shifting the plants loosen them first with a fork before pulling, place in a box roots downwards with as much soil as will adhere to encourage them to strike as early as possible. Dibble each plant in carefully, taking care not to allow the thin root tendrils to curl or lie upwards. If the roots are excessively long, it is a good plan to nip a few inches off. Plant from 16 to 18 inches apart. As soon as the weeds appear the plot may be worked by a horse and hand hoe. With this treatment and a fairly good season the cabbage should be ready for cow feed in February or March. There are one or two useful points to observe when feeding. The plant is best cut with an adze, leaving the root in the ground, fork it into the dray, and when full cart the cabbages to the open grazing paddock and spread them about on the grass far enough apart to permit the cows reaching them without interfering with each other. Every succeeding load should be spread over a fresh plot of grass. A good cart load is sufficient feed for 20 to 25 cows in full milk. Two perches of ground ought to provide that. I have taken from 1 perch this season 5cwt. 12lbs., which would give a return of over 40 tons per acre. Our experience goes to prove that cabbage is a splendid cow fodder, and never taints the milk. Cabbage, when well grown, with compact heads and closely over-lapping smooth leaves, are never liable to disease, but the nature of the plant has to be considered to get this result. It is a gross and greedy feeder, and requires good liberal dressings of manure to maintain a healthy growth. So long as this is provided there is no sign of disease, blight, or decayed under leaves. The susceptibility to disease only occurs when the plants are starved. I have abandoned the practice of collecting seed, as it is very apt to get cross fertilized. I purchase seed from reputable seed merchants. Sutton's have been used here with excellent results. The accompanying photographs are fairly representative of a good crop. The single specimen weighed 25 lbs. when cut. The foot rule across it gives an idea of the size."



1. Drum-head Cabbage weighing 25 lbs.
(1-ft. rule lying across the Cabbage.)

2 and 3. Mr. Goldie's Cabbage Plots for Dairy Cattle.

HINTS FOR SPAYING CATTLE.

By David Wilson.

When cattle are selected for spaying, care should be taken that they are in a fit condition for the operation. I have no doubt that in the past years, and especially since the dairying industry started in Victoria, a large percentage of the losses in spaying cattle could have been avoided had sufficient care been taken in the selection and preparation of the animals before being spayed, cleanliness, and the use of a good antiseptic while operating, and reasonable care of the animals for a few days afterwards.

The following points for the preparation, care, and selection of animals that are in a proper condition for spaying, and how to avoid those that are not safe or profitable to operate on, will be of value, and if followed out, will help to lead to that general success which is desirable:—

1. Cattle that have been driven by road or trucked on railways any distance should have at least a week's spell in a fair paddock, to allow them to freshen up before being operated on. Avoid all unnecessary driving of cattle either immediately before or after being operated on.

Keep the cattle in the yard all night (or from fifteen to sixteen hours) without food, so that they will be free from food when operated on.

As each beast is spayed turn it out at once into a handy paddock where there is feed and good watering places; avoid paddocks on the side of steep hills and boggy watering places for a few days.

The best weather for operating is when it is mild or warm; keen winds and cold rains should be avoided if possible. If the cattle are quiet, always work under the cover of a shed, so that the wind will not be blowing towards the incision while operating. Pay strict attention to cleanliness, and use a good antiseptic for washing the hands and arms, also wash the skin of the animal after the hair is clipped off, where the incision is to be made, with the antiseptic solution. When the operation is completed and the incision stitched up, tie on to the bottom and top stitches two pieces of calico so as to cover the incision, dress well with a mixture of Stockholm tar and boiled linseed oil in equal parts; this will keep the cold air from striking on the incision till it heals.

2. If cows in milk are the subjects, care must be taken that they have been calved fully six weeks, for it takes (on an average) that time, after calving, for the uterus and appendages to shrink to their normal condition, and thus make it safe for operating without danger of inflammation.

3. Cows in season should not be operated on until the heat and excitement pass off.

4. Heifers in calf should not be spayed, because it is hard for them to slip their calf, on account of their bearing not being softened by nature; they will do no good for some considerable time afterwards.

5. If, in the flush of your fattening season, a heifer or cow is three parts fat, and you know that she is not in calf, do not spay, as she will fatten without risk, especially if you do not want to hold her on for any time.

6. The cattle that do best when spayed are those that are operated on while in store condition; they will come on quickly, fatten well, and get solid.

7. Cows in calf can be spayed, if in the early stages under four months gone they usually slip the calf within three days; that does not hinder their condition to any extent. If forward in calf a number of them will carry their calf and rear it as usual; when it is sold as a vealer the cow will fatten rapidly afterwards.

8. Cows with calves at foot six weeks old or over, are very safe to spay and do well. Do not wean the calf for at least ten days after the cow is spayed.

9. If heifers are intended for fattening the most profitable age to operate is when about twelve months old or under; the risk is nil; they will grow like a steer, mature early, and do well on rough country until wanted for the fattening paddocks.

10. Aged dairy cows intended for milking on for a time should be spayed when in the full flush of milk six weeks after calving; they will get in better condition while milking, and, when dried off, fatten rapidly.

11. Culled or unprofitable dairy cows should be spayed six weeks after calving, and dried off at once for fattening.

CONFERENCE OF GOVERNMENT VETERINARIANS ON INSPECTION OF PIGS AND PIG PRODUCTS.

REPORT OF INTER-STATE CONFERENCE OF GOVERNMENT VETERINARY SURGEONS, REPRESENTING QUEENSLAND, NEW SOUTH WALES, AND VICTORIA, ON THE INSPECTION OF PIGS AND PIG PRODUCTS INTENDED FOR HUMAN CONSUMPTION, HELD AT MELBOURNE, 29TH JANUARY, 1902, AND SUCCEEDING DAYS.

Delegates:

W. C. QUINNELL, Esq., M.R.C.V.S., Department of Agriculture, Queensland.

ED. STANLEY, Esq., F.R.C.V.S., Department of Public Health, New South Wales.

S. S. CAMERON, Esq., M.R.C.V.S., Department of Public Health, Victoria.

Dr. Gresswell, Chairman of the Board of Public Health, in the absence of the Honorable the Minister of Public Health, opened the Conference, and, in so doing, said that he had the duty, the honour, and the pleasure, on behalf of the Honorable the Minister of Health and the Honorable the Minister of Agriculture, to extend to the visiting delegates a warm and hearty welcome to the Conference convened at the instance of the Government of Queensland for the purpose of considering in what way uniformity of action could best be secured for the inspection of pigs and pig products intended for human consumption. He had to express regret for the absence of the Honorable the Ministers of Public Health and of Agriculture, caused in the one case by ill-health, and in the other case by absence in Tasmania. Those gentlemen would have been pleased to have been present to have addressed the delegates in welcome, and also, no doubt, as to the importance of the matters the Conference was expected to advise upon. The letters received by the Honorable the Premier of Victoria were as follow:—

Chief Secretary's Office, Brisbane,
28th August, 1901.

Sir,

I have the honour to forward, for your perusal, the accompanying copy of a letter from the Department of Agriculture, enclosing copy of a memorandum by the Chief Inspector of Stock of this State (also herewith), in which it is suggested that a Conference of the Government Veterinarians of New South Wales, Victoria, and Queensland be held, with a view to securing uniform action regarding the inspection of pigs and pig products intended for consumption.

This Government approve of the suggested Conference, and I shall be glad to be favoured with your views on the matter, which I may state I have also referred to the Prime Minister of New South Wales.

I have the honour to be, Sir,
Your most obedient servant,
(Sgd.) ROBT. PHILP.

The Honorable A. J. Peacock,
Prime Minister of Victoria, Melbourne.

Department of Agriculture, Brisbane,
17th August, 1901.

Sir,

I have the honour to forward herewith a copy of a memorandum from the Chief Inspector of Stock, relating more particularly to the inspection of pigs intended for consumption. The Minister approves of the recommendation that a Conference of Government Veterinary Surgeons of Queensland, New South Wales, and Victoria be held, so that a uniform inspection of pig products may be determined upon, and I am to ask, should the Honorable the Premier agree, that a Conference may be arranged to meet in Sydney or Brisbane.

From Mr. Gordon's memorandum, it will be seen that possibly Queensland has been at a disadvantage as compared with the other States by faithfully following the recommendations of the Royal Commission on Tuberculosis.

I have the honour to be, Sir,
Your obedient servant,
(Sgd.) P. J. McDERMOTT,
Under-Secretary.

The Under-Secretary,
Chief Secretary's Department, Brisbane.

MEMORANDUM RELATIVE TO THE CONDEMNATION OF PIGS AT ZILLMERE.

When the Live Stock and Meat Export Act was passed, the Right Honorable H. M. Nelson, then Chief Secretary, communicated with the other colonies, suggesting that there should be veterinary inspection of all meat intended for export from Australia, intimating that unless such was the case, Queensland would be under the necessity for advertising the fact that all Queensland meat exported passed a veterinary inspection.

Mr. Reid (Zillmere Bacon Factory) informs the veterinarian that pigs condemned for tuberculosis here would be passed for consumption in the other States. I take this to mean that where tuberculosis is localized in pigs only the affected portions are condemned in the other States.

If that is so, then Queensland is at a decided disadvantage in following the recommendations of the Royal Commission on Tuberculosis, and I am of opinion that it would be to the advantage of our bacon factories that a Conference of the Government Veterinarians of

the three States, Queensland, New South Wales, and Victoria were held, and uniform action adopted. The Governments of the two last-named States might be asked to agree to such a Conference to meet either here or in Sydney.

(Sgd.) P. R. GORDON,
Chief Inspector of Stock,
12th August, 1901.

The Under-Secretary,
Department of Agriculture.

Dr. Gresswell said that if it were required to facilitate the deliberations, he should be only too happy to invite the members of the Conference to pay visits to meat works, abattoirs, and such like places; in fact, on the suggestion of Mr. Cameron, he had already caused intimations to be forwarded to various parties concerned that it was the desire of the Victorian Government that the members of the Conference should visit and inspect their works. Any further assistance that he (Dr. Gresswell) could afford the Conference he would be only too happy to render.

In conclusion, he said it was the desire of all, as it was the duty of those appointed in connexion with sanitary administration to secure, as far as practicable, a sound manhood and womanhood both for ourselves and the inhabitants of other countries, and it must be, therefore, their desire and their duty to discountenance any importation of meat into the market for human consumption not fitted for that purpose. It was in furtherance of that principle that, at the instance of the Queensland Government, the members of the Conference were present that day, and it was only necessary for him to say that he desired, in obedience to the instruction of the Government of Victoria, to make the stay of the visiting delegates as pleasant and their duties as light as possible. The *members would be left entirely to themselves to deliberate; no* principles were to be laid down for them; and their recommendations would receive the most careful consideration of the Governments of the States.

The Conference sat in committee on 29th, 30th, and 31st January, and 1st February; and on these days, and 3rd and 4th February, paid visits of inspection to the following establishments :—

South Melbourne Municipal Abattoirs.
Messrs. J. C. Hutton and Co.'s Bacon Curing Factory, Preston.
Melbourne Municipal Abattoirs, Flemington.
Mr. Angliss' Meat Works and Butcher's Shop, Melbourne.
The Victoria Meat Market, Melbourne.
Messrs. Barrow Bros.' Meat Sale Rooms, Melbourne.
Messrs. Gray Bros.' Meat Sale Rooms, Melbourne.
Messrs. J. C. Cook and Co.'s Meat Works, Newport.
Williamstown Municipal Abattoirs.

During the sittings of the Conference evidence of the systems of inspection at present practised in Queensland, New South Wales,

and Victoria respectively, and the legislation at present in force in these States for carrying out such inspection was presented and considered, and the following resolutions were adopted unanimously:—

RESOLUTIONS CONCERNING DISEASES AND CONDITIONS WARRANTING CONDEMNATION OF THE WHOLE OR PART OF THE ANIMAL.

Resolution 1.—*Tuberculosis*—"That when tuberculosis exists in only one organ, including the lymphatic glands receiving lymph from that organ, or in only one distinct group of lymphatic glands, or in only one other isolated situation, the part of the animal only which is so affected should be condemned; except when such local tuberculosis is concomitant with emaciation, in which case the whole carcass should be condemned."

Resolution 2.—*Tuberculosis*—"That when tuberculosis exists in two or more places (organs, glands, membranes, or tissues) not directly connected by lymphatic vessels, the whole carcass should be condemned."

Resolution 3.—*Tuberculosis*—"That the detection of the presence of tuberculosis in any degree in a dressed carcass, or in any portion thereof, warrants the condemnation of such carcass or portion."

Resolution 4.—*Actinomycosis*—"That the resolutions referring to tuberculosis should also apply to the disease known as actinomycosis."

Resolution 5.—*Specific Diseases*—"That pigs affected with the following specific diseases in any stage be condemned, viz.—Anthrax, hog cholera, or swine fever, parturient fever, septicæmia, pyæmia."

Resolution 6.—*Parasitic Diseases*—"That when either of the parasites, cysticercus cellulosa (measles), or trichina spiralis, or lesions caused by these are present in an animal, the whole carcass be condemned."

Resolution 7.—*Parasitic Diseases*—"That in a well-conditioned carcass the presence of hydatids, flukes, or other internal microparasites, as also the presence of ticks, lice, or dermatozoa, does not justify condemnation."

Resolution 8.—*Other Disease Conditions*—"That the existence of any of the following diseases or abnormalities in certain stages may necessitate the condemnation of the animal, either wholly or in part, that is to say:—Pneumonia, quinsy, asphyxia, anæmia, jaundice, fever, congestion, abscesses, fractures, bruises, wounds, gangrene, emaciation."

Resolution 9.—*Post-mortem Changes*—"That the existence in any carcass or portion thereof of putrefaction, discolouration, congestion, flabbiness, *post-mortem* staining, or the presence of insect larvæ, to a degree rendering such carcass or portion offensive, or loathsome in appearance, or unwholesome, warrants the condemnation of such carcass or portion."

RESOLUTIONS CONCERNING INSPECTION METHODS.

Resolution 10.—*Inspection Methods*—" That on slaughter every carcass should be cut open from the pelvis to the chin, and the pluck (by which is meant the lungs, heart, and liver, with their lymphatic glands) should remain attached to the carcass by the trachea or windpipe until inspected; and that the abdominal viscera be examined at time of slaughter."

Resolution 11.—*Inspection Methods*—" That for the effective inspection of pig carcasses, when tuberculosis is present in any organ or part in any degree, all groups of lymphatic glands should be successively examined until the evidence required in Resolution 2 is met with."

RESOLUTIONS CONCERNING QUALIFICATIONS OF INSPECTORS.

Resolution 12.—*Qualification of Inspectors*—" That for the carrying out of effective methods of inspection, all meat inspectors should be required to manifest, by means of examinations of uniform standard throughout the various States, the possession of a sound and sufficient knowledge of the following subjects, viz.:—" (*a*) Animal anatomy, physiology and pathology, and animal diseases; (*b*) the principles of sanitary science as applied to abattoirs and to the management of animals; (*c*) the practical details and methods of preparing, dressing, and manipulation of meat foods; (*d*) the laws relating to meat inspection."

Resolution 13.—*Supervision of Inspection*—" That the inspection of food, animals, and meat should be carried out by certificated inspectors, under the supervision of qualified veterinarians."

RESOLUTION CONCERNING REQUIRED LEGISLATION.

Resolution 14.—*Required Legislation*—" That this Conference affirms the necessity of the systematic inspection of all pigs and pig products intended for human food in any form, whether fresh or preserved, and strongly urges the desirability of the introduction of uniform legislation to enforce such inspection in the different States."

The Conference has the honour to respectfully submit the above Resolutions to the Governments represented for consideration as recommendations towards securing uniform action regarding the inspection of pigs and pig products intended for consumption.

(Sgnd.) WILMOT C. QUINNELL, M.R.C.V.S.,
(Sgnd.) E. STANLEY, F.R.C.V.S.,
(Sgnd.) S. S. CAMERON, M.R.C.V.S.,
} Delegates.

Melbourne, 5th February, 1902.

VITICULTURAL BRANCH.

TREATMENT OF VINTAGE BY DIFFUSION.

By Pierre Andrieu.

TRANSLATED BY R. DUBOIS AND W. P. WILKINSON.

(*Continued from page* 166.)

CHAPTER IV.

Superiority of Treatment of Vintage by Diffusion. Advantages Resulting from its Application to Different Methods of Wine Making.

Vinification of White Wine.—We have shown (page 159) that fresh vintage, crushed, drained, and pressed, retained an average quantity of juice equal to 16·5 per cent. of the must obtained by this treatment. We also saw (page 163) that by using diffusion with cold water the loss of juice was reduced to 2·5 per cent.

Diffusion allows, therefore, the extraction of 14 per cent. more than the treatment with presses. This gain increases together with the maturity of the grapes.

An important consideration which must also be mentioned is that the must extracted by diffusion is pure and bright. It does not mix with the water of vegetation contained in the solid parts of the vintage, and it contains neither earth nor fragments of bunches—all these considerations being favorable to the future quality of the wine.

Vinification of Red Wine for the Manufacture of Brandy.—The gain in juice is similar in this case. The clear must favours perfect fermentation, and allows, therefore, spirits of finer taste and more delicate perfume to be obtained.

Vinification of Red and Sweet Wines—Their Vinification as Red Wines.—When over-ripe grapes are used for making sweet wines the marc has to remain a very long time on the press, on account of the syrupy state of the must, and this peculiar state causes a considerable loss in juice. In this case the treatment by diffusion is still more advantageous.

The fermented marc resulting from the vinification of sweet liquor wines as red wine also causes a certain loss when pressed, which may be avoided.

Vinification of Red Wine.—The usual process of making red wine causes, as has been explained on page 153, important losses of wine, which may be avoided by using the diffusion method. We saw that with Gamai they reached 12·48 and 14·34 per cent. As a rule we may take an average loss of 12 per cent. for all varieties cultivated for the manufacture of wine. The diffusion with cold water causes a loss of 2·5 per cent., and with warm water 1·5 per cent., making an average

of 2 per cent. loss. The diffusion method allows us, therefore, to make a gain of 10 per cent. in the volume of the wine obtained. But other advantages of great value result from this new method:—

(*a*) Doing away with press wines, which are always of inferior quality.

(*b*) The must alone is fermented. This results in a better fermentation at a lower temperature, as the floating head of marc is entirely done away with. Certainty of not having the wine turning acetic, the main cause of this being the presence of the marc. This accounts for white wines being always of higher quality than red wines in hot climates.

(*c*) As the pressing is done away with all the operations connected with de-vatting are suppressed, and reduced to a simple racking done at any time, leaving only very little lees at the bottom of the fermenting tank, as the must is not muddy. Under these conditions the wine becomes bright quickly, and may be placed on the market earlier.

(*d*) Possibility of making white wine out of juice resulting from the drainage of red grapes, and making good sound red wines, rich in colour, with the rest of the marc. Some varieties yield, under these conditions, blending wines of remarkable value.

(*e*) Possibility of obtaining red wines of an average alcoholic strength of 10 per cent. higher than with any other process, as the water of vegetation of the solid parts is not mixed with the must.

(*f*) Easy sterilization of red must and use of selected yeasts, which may then produce their maximum effect.

(*g*) Diminution of one-fifth of the capacity of the vessels used for fermenting purposes. Possibility of doing without tanks or large vats, as the fermentation can take place in hogsheads. This simplification will render great service in newly-established vineyards.

Vinification of Fine Red Wines.—The advantages of the treatment are still more apparent in this case, on account of the high market value of this class of wines. We will take as an example the treatment of the vintage and its vinification in a classed growth of Bordeaux, as it is actually done, and as it could be done with the diffusion process.

The grapes of Cabernet-Sauvignon, Malbec, and Cabernet-franc (the first making about three-quarters of the bulk) are stemmed and sorted, then crushed under the feet and thrown into the fermenting vat. The fermentation lasts from 20 to 25 days. When the fermentation is completed the wine is put into hogsheads, the marc pressed, and the pressed wine resulting from this operation sold separately, and the pressed marc is used to make piquettes for distillation.

The grapes used have not a very agreeable taste. They do not bring with them any bouquet or any volatile perfume, except, perhaps, the perfume existing in the skin, which is common to the grapes of all European vineyards, and which disappears during fermentation. During the maceration of three weeks in the vat, the solid parts of the grapes yield their soluble matters, which are added to the matters

necessary to the good constitution of the wine, but which have no marked action on its bouquet, for the white wines of classed growth are very perfumed, although they are not fermented in the presence of the solid portion of the grapes which produced them. The yeast and the maturing alone—that is to say, the slow action of the air through the staves of the cask acting on the alcohols, acids, and other bodies constituting the wine of each growth—develop the bouquet and give to each Bordeaux wine its special characters.

If, on the contrary, this same vintage is crushed and drained, and if the remaining sweet marc is afterwards treated by diffusion, we may submit this marc in the diffusion battery to a temperature gradually rising to 60 or 70 deg. C., and afterwards falling to normal. We will have in this way extracted in six or seven hours from the marc the soluble matters which would have required three weeks to be extracted by the usual method of fermentation. The must obtained by diffusion being added to that obtained by drainage, the fermentation takes place with liquid matter only, as is actually the case with white wine, and is much simplified.

We obtain, as we have already shown, a volume of wine 10 per cent. greater than that actually obtained (or, what comes to the same, an alcoholic strength 10 per cent. higher, according to the way in which diffusion is applied). We will have only wine of first racking, no press wine, whence a greater profit; and the wine by maturing acquires the same bouquet as that made by the usual process. It even acquires greater finesse and a more delicate taste, for the solid parts of the vintage have only been diffused during the time necessary for their exhaustion.

It is also possible, by blending the must obtained by drainage and that obtained by diffusion in different proportions, to obtain wines varying in quality and answering the taste of consumers. We think, therefore, that the application of diffusion to the vinification of red wines of classed growth can only prove beneficial.

To sum up, all wines, common, red, white, liquor, may be treated with great advantage by the diffusion method.

CHAPTER V.

Wine-making Machinery done away with.

Treatment by diffusion requires, naturally, special apparatus, which will be described hereafter, but it does away with a large portion of the wine-making machinery now used, and we shall study this item. The wine-making machinery is not similar in every cellar.

The machinery used for the *vinification of red wine* is pretty well similar in all cellars; everywhere the vintage has to be pressed and the must fermented in vats, the size of these being the only difference. If diffusion is applied to the manufacture of red wine, we save the cost of the press and also the tanks in which the marcs are treated after pressing for the manufacture of piquettes.

Let us study the cost of a press-room with its machinery for the production of 1,600 hectolitres gathered in sixteen days, that is to say, a production of 100 hectolitres of red wine per day.

If we assume that 150 kilos. of vintage are required to produce 100 litres of wine, we require to treat 1,500 kilos. of vintage to obtain 100 hectolitres of wine. Assuming that the weight is reduced by 33 per cent. after drainage, we require to press 10,000 kilos. of sweet marc. Two presses, with a table 3·20 metres square and a diameter of 2·60 metres, with a screw 0·15 metres, will be needed.

These two presses cost	£184
Four drainers and their table	40
A Blaquière drainer	16
A press room 16 x 7 ms., with roof, ceiling, cement floor, doors, and windows. Approximately*	160
Total	£400

If we divide this figure by 1,600 (number of hectolitres) we obtain a sum of 6·25 francs, corresponding to the amount necessary to obtain one hectolitre of wine by the press system.

We must also take into account the building of the presses used for the manufacture of piquettes.

The machinery used for the manufacture of *red wine* has more variety. The vintage, after having passed through a crusher, and sometimes through a stemmer, is put in special tanks to ferment. In the south of France the fermentation is sometimes done in vats, which are used afterwards for storing the wine, but in newer cellars this is done away with, and the vintage is fermented in special rooms, as is also done in other countries. The fermenting vats are placed in a fermenting house, and are made of wood, iron, brickwork, or Monier cement. When the wine is fermented it is racked and stored in another room (cellar proper), where it is treated until matured.

With the diffusion system the fermenting house, fermenting vats, and presses are done away with. The must for red wine is taken into the cellar straight away and is fermented in casks, as is actually done for white wine. We will try to ascertain the economy realized with this system. Let us take a vineyard in the south of France, for instance, with a cellar and a fermenting house large enough to make 4,000 hectolitres of wine. Assuming that 100 kilos. of vintage yield 78 litres of wine, which is the average for that region, the total amount of vintage treated will be 512,800 kilos. If the gathering lasts sixteen days, the weight of vintage treated every day will be 32,000 kilos., filling two fermenting tanks of a capacity of 180 hectolitre each. Assuming that the fermentation lasts from four to five days, the fermenting house should contain twelve tanks, or a total capacity of 2,160 hectolitres. The machinery will include two large presses on cement tables, a screw 15 cms. in diameter, and a crusher.

* These figures are taken from the work of P. Ferrouillat and Charvet, *Les Celliers*. Montpellier, 1896.

The vats, occupying less room, are thus made of cement, and are cubic in shape; they are disposed in lines along the sides of the fermenting room. A road is made for the drays to unload the vintage above the level of the vats.

The fermenting house will be 39 ms. x 8 ms., inside measurement, and 7 ms. in height. Assuming that this room is built adjoining the cellar, we have to reckon upon:—

Building, roof with Marseilles tiles, with concrete floor, road to bring the vintage above the vats ...	£350
Twelve fermenting tanks of 2,160 hectolitres each ...	276
Two presses with cement table	150
A Blaquière crusher	16
Total	£792

The cost of production of one hectolitre of wine will therefore be 4 shillings. This cost is increased if wooden vats are used, as they require more room and are more expensive.

In the vineyards of Bordeaux and Bourgogne wooden vats under 150 hectolitres are used. In this case the number and capacity of the vessels is greater compared with the total weight of vintage. This is done because each vat will produce wine of a certain quality, and also because the vintage does not last as long and the fermentation lasts longer. The presses are smaller than those used in the south, and therefore more expensive. The capital value of the fermenting room compared with one hectolitre of wine is in this case much higher, as may be seen from the following example:—

At Chateau Malescot-Saint-Exupery, Parish of Margaux, in the Gironde, the quantity of wine made annually averages 1,740 hectolitres. The vintage lasts a fortnight. A new fermenting house was built lately with 20 closed vats of 150 hectolitres each, making a total capacity of 3,000 hectolitres. This shows that each fermenting tank is used only once during the vintage. The fermenting room and its machinery cost £1,748, which brings the cost of manufacture of one hectolitre to 24 francs.*

If the diffusion process were used we would require a fermenting house of a total capacity of 2,000 hectolitres only, as must alone would be fermented, and the fermenting room would only cost £800; on the other hand, the diffusion room, with its machinery necessary to treat 16,000 kilos. of vintage per day, would cost about £680, which will mean an economy of from £240 to £280.

We are now going to study the erection of different types of diffusion rooms, according to the magnitude of the vintage.

* These figures are extracted from *Les Celliers*, already mentioned.

CHAPTER VI.

Diffusion Plants—Their Cost and Installation.
Viticultural Industry and Sale of Grapes.
Viticultural Co-operative Societies.

Before entering into details as to cost of machinery for diffusion, we must point out that the machinery is the same whether red, white, sweet, or dry wines are made.

In the calculation of the yield of juice and wine resulting, we shall take as basis a vintage yielding a must of a specific gravity of *1,075 (which* means an *alcoholic* strength of *10* per cent. for white wines).

In the manufacture of red wine, vintage of a total weight of		100 kilos.
Will be composed of dry solid matters...	5 kil.	14 „
Water of vegetation	9 „	
The total weight of juice will be ...		86 kilos.
If the specific gravity be 1,075, the volume of the juice will be		80 litres
From which we must deduct 2·5 per cent. loss by diffusion...	2 lit.	4 lit. 5
Loss by fermentation	2 „ 5	
Total quantity of wine obtained from 100 kil. of vintage will be... ...		75 lit. 5

We may assume that in the manufacture of red wine, the wine will be similar to that which would have fermented in contact with the solid parts.

The grapes may be constituted as above, and represent a total volume of pure juice of ...		80 lit.
Plus water of vegetation		9 „
Total volume		89 lit.
From which we must deduct loss by diffusion	1 lit. 37	3 lit. 90
Loss by fermentation	2 lit. 53	
Total quantity of red wine obtained from 100 kil. of vintage will be ...		85 lit. 10

Diffusion plants may be installed in various ways according to circumstances. Those described hereafter answer the most general requirements.

No. 1.—Diffusion Plant treating from 1,000 to 1,700 Kilos. per Hour.

This consists of diffusers of 760 litres capacity, such as those used in our experiments at Cabezac (Fig. 2). We will remind :—

That with crushed vintage placed directly in the tanks it treats 1,080 kilos of vintage per hour.

That with vintage draining from the diffuser during the operation of filling, it treats 1,400 kilos. per hour.

Finally, that with vintage crushed and drained in a special apparatus it treats about 1,700 kilos. per hour.

In the manufacture of red wine, assuming a yield of 85·10 litres, as above indicated, we obtain for 16 days at 12 hours a day :—

In the first case	... ...	1,760 hectolitres
In the second case	... ...	2,285 ,,
In the third case	... ...	2,777 ,,

Fig. 3 shows the plan and elevation of a diffusing room with its 10 diffusers placed around the centre. In Fig. 2, page 161, they are disposed in two parallel lines adapted to the use of a narrow and long room ; the expense is the same in both cases.

In the circular system the tanks G are made of wood. Their capacity may vary between 350 and 1,200 litres. The drays carrying the vintage come up by the road B (Fig. 3), which brings them about 4 feet above the top of the tanks, and the vintage is unloaded on the floor C. The vintage is crushed in the crusher A, and is taken by a shoot in comports, or in special drainers 16 inches high, and placed on the floor D. It is left in those drainers for an hour, and then put in comports carried on small trucks. Each truck carries four comports, or 300 litres of marc ; three only are required, one being filled, one being emptied, and the third ready to be filled. They run on circular rails fixed to the floor E, and may be stopped before each diffuser.

This arrangement, as may be seen, does away with the greater part of manual labour. Before filling the tank its lid J is raised with the aid of the crane L. The bottom tray is first placed in the tank, which is filled to half its height ; the second tray is then placed in its position, and the filling completed. The lid J is lowered, fixed with thumb screws, and the tube N, which allows the escape of gas, is coupled to the lid.

When all the tanks are filled in this way, they are coupled together by means of tubes, so as to allow the circulation of water from the tank O to the hose Q. The must flows out of the tail tank No. 9 in this case, while the tenth is being filled, the operation being conducted as explained in Chapter 3. Before emptying the head tank, the bottom tube is opened to allow the water to escape, its lid is raised with the crane L, and the two trays secured to a centre tree-eye are raised in one block with the crane K. They are lowered in the empty space facing the crusher into trucks, which carry them away through the passage P. The water heater H travels on circular rails inside the circle of tanks, and can be connected to each tank.

The drained and diffused must travels through one or two channels, as the case may be, into one or two tanks in the room R, from which it is pumped into the fermenting vessels.

Cost of Plant with Diffusers of 760 litres each.—The diffusion room built against the cellar R is 10·40 x 9·30 metres, and 8·50 metres high. It is a light structure, with walls 50 cms. thick. This building, with its concrete floor, its road, wooden flooring, &c., would cost £240.*

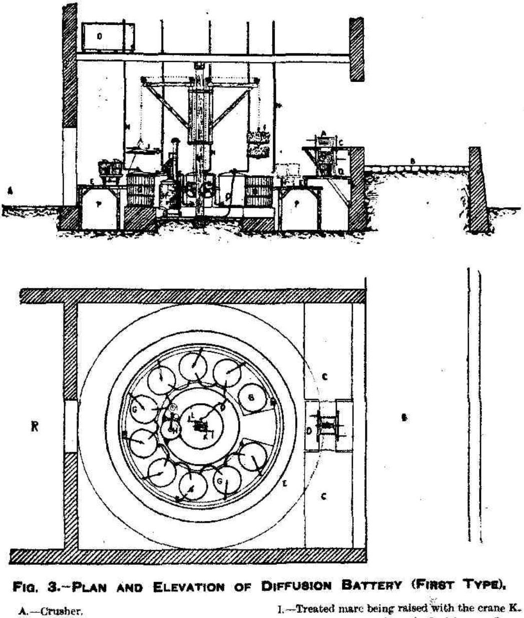


FIG. 3.—PLAN AND ELEVATION OF DIFFUSION BATTERY (FIRST TYPE).

A.—Crusher.
B.—Road.
C.—Floor where the grapes are unloaded.
D.—Floor for receiving the crushed grapes.
E.—Circular platform.
F.—Trolly for carrying the vintage.
G.—Diffusion tanks.
H.—Warm water generator.
I.—Treated marc being raised with the crane K.
J.—Lid of diffuser being raised with crane L.
M.—Centre stay.
N.—Pipe for escapement of gas.
O.—Water tank.
P.—Passage for carrying away the treated marc.
Q.—Water delivery.
R.—Cellar.

* Figures taken from *Les Celliers*, already mentioned.

COST OF MACHINERY.

Diffusion battery with 10 diffusers of 750 lit., tubes, trays, &c. ...	£240
Double revolving crane	18
Circular rails and three trucks	16
Three drainers	18
One crusher	16
One water pump, water tank, and pipes	28
Installation, sundries	40
Total	£376
With water heater complete	48
Total	£424

The total cost of the diffusion room and its machinery will therefore be £240 + £424 = £664, which brings the cost of manufacture of one hectolitre :—

For production of 1,760 hectolitres	(first case) ...	9·40 francs
" " " 2,285 "	(second case) ...	7·25 "
" " " 2,777 "	(third case) ...	5·95 "

This cost would naturally be diminished if the capacity of the tanks were greater. For instance, tanks of 1,000 litres working 16 days under the same conditions would turn over 3,654 hectolitres of red wine if the vintage were previously drained. In this case the capital of the fermenting room would be 19,000 francs, and the cost of producing one hectolitre would be reduced to 5·20 francs.

Applied to the manufacture of red wines, the above plant would turn over 3,240 hectolitres, and the cost of producing one hectolitre would be 5·86 francs.

These figures, compared with those of the previous chapter, for the plant actually in use, are, perhaps, rather in favour of the latter.

No. 2.—Diffusion Plant treating 100,000 Kilos. of Vintage per Day—Its Cost.

Figs. 4 and 5 give the plan and elevation of such a plant. It is composed of twelve diffusers E, ten composing the battery, and two being filled while the diffusion is proceeding, a draining room R, and an engine-room M.L.

The vintage is brought on the floor B, is crushed at A, where it drains on a wire netting, travelling slowly over rollers from A towards B, where it is elevated by the elevator C up to the shoot D, which takes it into each diffuser.

These diffusers are made of iron. If the iron is kept clean, and if the vintage does not remain a long time in contact with it, the latter does not acquire any bad taste. In this case each diffuser contains 1,660 litres, and these are filled with the marc from 2,790 kilos. of vintage. As the number of diffusers is in this case 12, and as they are 2·50 metres in height instead of 1·20, as in the previous plant, and

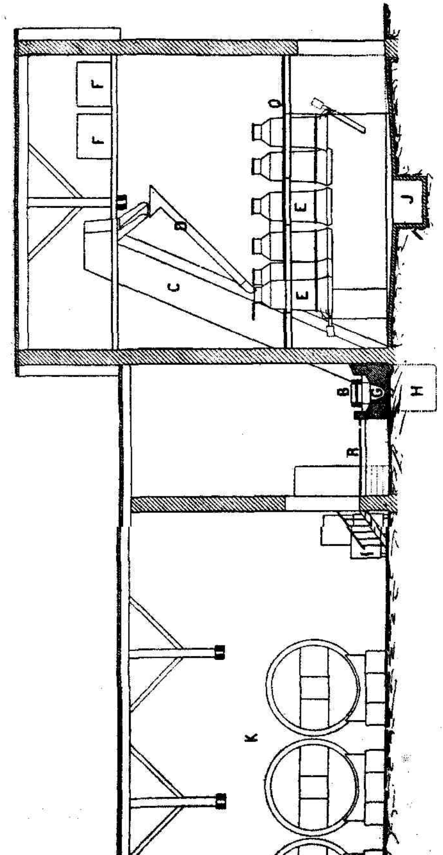


Fig. 4.—Elevation of Diffusion Room (Second Type).

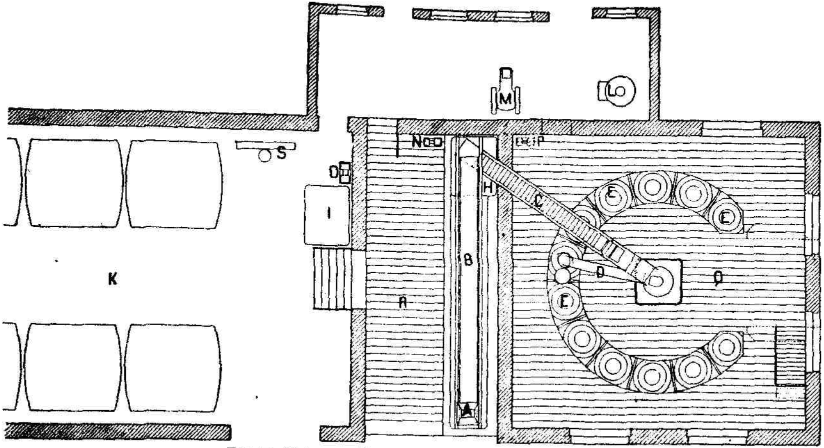


FIG. 5.—PLAN OF DIFFUSION ROOM (SECOND TYPE).

A.—Crusher.
B.—Horizontal carrier and drainer.
C.—Elevator.
D.—Distributing shoot.
E.—Diffusers.
F.—Water tanks.
G.—Drain carrying the juice in tank H.
I.—Tank for storing the juice from the diffusers.
K.—Cellar.
L.—Warm water generator.
M.—Engine.
N.—Pump lifting the juice from the drainer.
O.—Pump lifting the juice from the diffusers.
P.—Pump lifting the water of diffusion.
Q.—Top floor.
R.—Floor where the grapes are unloaded.
S.—Sterilizer.

as the effects of diffusion are in direct relation with that height, it results that to obtain the same exhaustion of the vintage the head tank should be refilled every twenty minutes. This will allow the treatment of 8,350 kilos. per hour, or 100,000 kilos. of vintage per day of twelve hours. This quantity corresponds to 12,080 hectolitres of white wine in sixteen days, or 13,610 hectolitres of red wine during the same time on the base indicated at the beginning of this chapter.

The exhausted marc is removed from the base of the diffuser, the bottom revolving on a hinge, and dropping the whole marc in one mass. On the bottom is fixed a perforated tray similar to those of the above type, and on the sides of the tank is a perforated sheet facilitating the circulation of the liquid. The exhausted marc falls from the diffuser on the cement flooring, and its water runs in an underground tank J, from which it is pumped into the water tanks F.

The juice resulting from the diffusion is taken by a hose into the tank I; it is taken together with the drained juice of the tank H by pumps N and O in the cellar K. The pump P lifts the diffusion water.

In the engine-room is a boiler L, and an engine M.

Finally, in the cellar is a pasteurizer (Houdart's system) S, which may be used either to sterilize the musts or to cool them.

Cost of Plant.—The cost of construction of the three rooms (crusher, diffuser, engine), calculated on the same basis as above, assuming that the diffusion room is 10 × 13·50 metres—

Same flooring, underground tanks, &c.	£360
Crushing room, floor, tanks, gutters	88
Engine room, floor, light roof	48
Total cost of building	£496

COST OF MACHINERY.

1 *diffusion battery* with 12 diffusers of 1,700 litres emptying from the bottom, piping, taps, &c. ...	£800
Iron floor with iron column supporting diffusers ...	92
1 crusher worked by steam	32
Travelling drainer with its pulleys	140
Elevator and its pulleys	140
Shoot and its mechanism	16
Iron and wooden tanks	36
1 boiler complete	140
1 engine, 8 H.P.	100
Shafting and belting	32
2 steam pumps for must	36
Piping, installation, sundries	236
Total* ...	£1,800
With stationary water heater	200
Total ...	£2,000

* The cost of the sterilizer refrigerator, Houdart's system, does not figure in the above specifications, as sterilization has not yet become the general practice, but numerous experiments prove that this is an excellent method, not increasing the cost of vinification if the above-mentioned machine is used, as the total amount of heat is completely recuperated.

Therefore, in the above instance where 12,080 hectolitres of red wine are made, and where the total capital amounts to 45,000+12,400 =£57,400, the cost of producing one hectolitre is 5·16 francs.

For a production of 13,610 hectolitres of red wine the cost of producing one hectolitre would be 4·58 francs.

These figures, compared with those of Chapter III., are in favour of the diffusion process.

It must be remembered that the use of steam power in connexion with the diffusion battery lowers the cost of labour. If we assume that men working in the cellar are paid 5 francs per day, one hectolitre of wine will bear 0·25 and 0·30 of that amount. This cost is already reduced in the case of the diffusion battery No. 1. It is increased in the manufacture of fine wines on account of the sorting of the grapes, which cannot be done by machinery.

With the application of steam power the 13,610 hectolitres of red wine bear 0·12 francs per hectolitre of the cost of manual labour, coal, and wear and tear of machinery.

To sum up, the many advantages resulting from the application of diffusion to the treatment of vintage, as have been already explained in Chapter IV., are not lessened by the cost of installation of the new plant, and the labour attached to it; it is the contrary that takes place

Viticultural Industry and Purchase of Grapes.—It is the custom in certain vineyards, especially those recently established where there are not wine-making appliances, to sell the crop beforehand. The vendor gathers the grapes latter on, weighs and delivers them to the buyer under conditions specified previously.

In districts where this mode of proceeding is the custom it would be to the advantage of growers to have several wine-manufacturing houses where the vintage could be treated by diffusion. This would obviously benefit both buyer and vendor.

Treatment of Vintage by Diffusion and Co-operative Viticultural Societies.—Except in the case above mentioned, diffusion cannot be applied in small vineyards. It is an expensive method of treatment if the quantity of vintage treated yearly is not sufficiently large. But why should the small grower not do for vintage and vinification what is done by the small farmers of France for the manufacture of cheese, butter, beetroot spirit, &c.? For instance, co-operative agricultural societies for the distillation of beetroot spirit are already very numerous. Ten, 20, or even 100 farmers associate together to have a distillery erected which will be able to work a certain number of tons of beetroot per day. They form a co-operative society for production, settle the area to be planted every year, and each shareholder undertakes to sow the quantity of seeds furnished by the directors of the society. During the cropping season the beetroot of each farmer is weighed on arrival at the distillery, and the density of juice in sugar is ascertained; these two data serve to establish the distribution of net profits between the shareholders. These societies have a very large liability, they obtain credit easily, write off their capital regularly every year, and the shareholders are all satisfied with this work in common, which gives them larger profits than any other system.

The same thing would apply to small vine-growers gathered together round a centre. There is nothing to prevent them from forming such a co-operative society for the manufacturing of their wine, and to have only one single fermenting house, and one single cellar in common. It would be very easy to establish beforehand a rule for the distribution of profits, and the sale of wine made at the central cellar. This distribution would be based on the weight of vintage brought by each shareholder, the specific gravity of the must, the nature of the grape, the age of the vine, and the soil which influences the quality of that vine. Such a society might establish and control certain methods of pruning for certain varieties, and foresee all the circumstances enabling the establishment of a fair distribution of profits, as is done by all co-operative agricultural societies for production.

Small growers are labouring under disadvantages, especially since the reconstitution with American vines. The cost of cultivation of grafted vines is somewhat higher than with the old French vines. The modern wine-making appliances used for a small quantity of vintage become extremely costly; the losses in the manipulation of the wine reach a high average, and the wine is more often than not stored in unsound casks, where it cannot be properly taken care of and matured, and further, it is not sold as easily as the same wine made by large producers, on account of the small bulk.

Small growers, however, have an advantage over large firms. Their vines may be better cultivated, and the yield increased. They would therefore get the best of the bargain if they would co-operate with their neighbours to manufacture their wine in common.

HINTS FOR THE VINTAGE.

(*Continued from page* 182.)

By R. Dubois, B.Sc.

Wine-making.

By the time this article appears, vignerons in the warmest part of the State will have started gathering their grapes, and, in some cellars, vats will be in full fermentation. We shall in the following pages answer as closely as possible inquiries recently received from vine-growers.

The time at which the grapes should be gathered was considered in our February issue. We will now give attention to the various operations after the grapes have been crushed and placed in the vat.

At what Temperature should we Ferment the Must?

In order to ascertain the temperature of the must, the wine-maker should always use a thermometer, as the future quality of the wine depends greatly on the temperature at which it ferments. The results of investigations made by leading authorities are that 86° F. is the temperature at which the ferment or yeast can best act upon the sugar and transform it into alcohol and other matters.

Unfortunately, fermentation usually takes place at too high a temperature owing to the vigneron not employing a thermometer or any means of cooling the must. The result is that vats in full fermentation suddenly stop or "stick," as it is termed locally, and in many cases it is impossible to start fermentation again. In such circumstances the wine remains sweet, cloudy, cannot be fined, and, sometimes, turns and sours when about nine months old. By observing the temperature of the must during fermentation, the following phenomena will be remarked :—

1st. The temperature remains constant, or rises very slowly for about 24 hours. At this period the yeasts multiply.

2nd. The temperature suddenly rises to 100° F., or above, and falls slowly, not to rise again. It is at this period that intense chemical changes take place, the yeasts nourishing themselves, so to speak, at the expense of the sugar.

Theoretically, it is only necessary to refrigerate once while the temperature is rising, but in practice the must is generally refrigerated twice ; first, directly after crushing, and, secondly, when 86° is reached. This is generally sufficient, and in most cases it will be found that the must does not rise again above what may be termed the critical temperature. The owners of small vineyards may manage to pick their grapes during the cool hours of the morning, thus starting at a lower initial temperature, they may do away with the first cooling.

Again, the grapes picked during the day may be spread over a floor, or kept in baskets and sprayed with water. The evaporation, especially if they are exposed to the wind, will cause an important fall

of temperature. Last year, at the Viticulture Station, the temperature of the must, after vats were filled with grapes cooled in this manner, varied between 57° and 65° F. The addition of water to the must (for there is addition of water to must in this case) in such small quantities can be tolerated.

What Cooler would you Advise us to use?

Many methods of cooling wine are employed in countries where the temperature is too high to admit of must "fermenting dry" straight

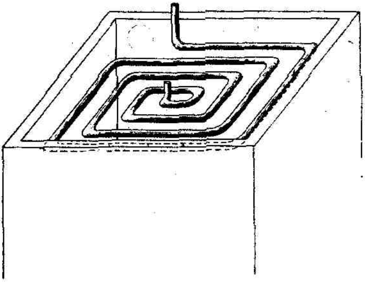


FIG. 1.
DIAGRAM OF IMMERSED WINE-COOLER.

away. Roos made an elaborate study of the coolers used on the continent, and those interested may read with advantage his chapter on

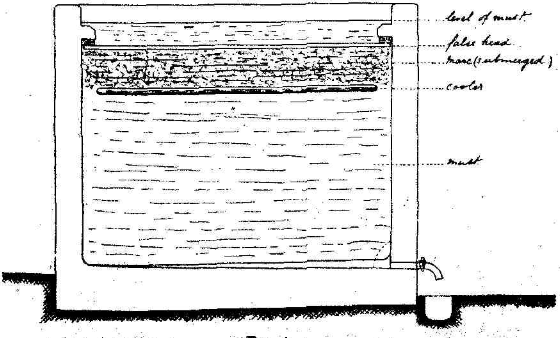


FIG. 2.
VERTICAL SECTION SHOWING ARRANGEMENT OF FALSE-HEAD AND COOLER IN THE FERMENTING VAT.

the refrigeration of must during fermentation in *Wine-making in Hot Climates*, page 107.

Here, in Victoria, we have two cases to consider, (1) where there is a plentiful supply of cool water—say about 70°—handy to the cellar, and (2) where the water supply is limited.

In the first case the cheapest way of cooling is the system employed in several cellars in Rutherglen and the Goulburn Valley. This consists in having a long thin copper pipe, tinned outside, of about 1 inch in diameter. This pipe is coiled horizontally (Fig. 1) so as to occupy the whole surface of the vat, and is immersed in the must immediately below the head of marc (Fig. 2), where the temperature is always the highest. Directly the temperature rises in the vat, which is ascertained by using the thermometer at regular intervals (every hour for instance) a current of cold water is sent through the coiled pipe, while the must is pumped overhead, to mix the different parts and create an even temperature through the mass. Where there is a large supply of water at command, this method will enable the wine-maker to prevent the temperature from rising above 86° F. But, in the second case, when the water supply is limited, as is too often the case, one cannot think of utilizing the submerged cooler. We must adopt some device made on the Muntz and Rousseaux principle. (See *Wine-making in Hot Climates*, pp. 116 and 248.) Unfortunately, these machines made of thin copper tubes, tinned inside and mounted on cast-iron pillars, are expensive. Small growers may, however, make such coolers themselves at little cost in the following manner:—

Buy sixteen pieces of galvanized gas piping, 1½ inches in diameter, and 12 feet long. This will make 192 feet of piping. As the price is about 9d. per foot, the total cost will be £7 4s. Get these pipes tinned inside. Take three pieces of oregon 4 feet long, and about 5 inches by 2 inches. These are required to support the tubes, which are piled horizontally one above the other, and should be prepared in the following way:—

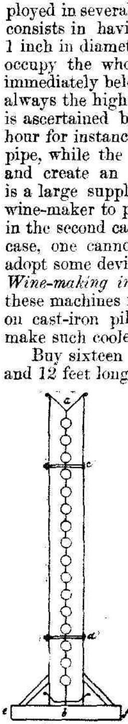


FIG. 3.
VERTICAL SECTION OF WINE REFRIGERATOR.

Bore sixteen holes with an auger of 1½ inches diameter, leaving 1 inch between each hole, and then saw through the centre line (*a b*) (Fig. 3). The sixteen tubes are clamped between these pieces of wood, which are kept together by two bolts (*c d*). The bottom of each prop can either be driven into the ground outside the cellar, or mortised to a stand (*e f*) so as to render it movable. On the top of each prop make a V-shape cut as in Fig. 3 to support the trough distributing the cold water over the pipes. This trough can be made of galvanized iron, bent V-shape, with a row of holes along the bottom. Another trough is required at the bottom of the machine, to collect the warm water. To complete the machine, take sixteen pieces of rubber hose, 1½ inches inside diameter, and about 1 foot long, and secure them at the end of the pipes, as shown in Fig. 4. The cooler is now completed and ready for

use. Cold water taken from a tank above is allowed to run into the top trough (*a b*), while the warm must is pumped through the bottom pipe *f*. As it slowly rises, the must comes in contact with colder water, and comes out of the top pipe *e* at a temperature equal to that of the water in the trough. If the apparatus is placed outside the cellar and exposed to the wind, the temperature will be greatly lowered by the

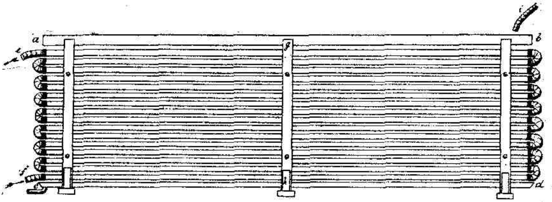


FIG. 4.
ELEVATION OF WINE REFRIGERATOR.

evaporation taking place on the outside of the tubes. With this device, very little water is required; and, further, it is not wasted, as it can be collected in the bottom trough, and allowed to run in an open tank, where it will cool during night. The wine coming out of the cooler should be spread all over the head of marc, by putting a plank under the nozzle of the hose and shifting it every few minutes. Twenty minutes to half-an-hour are generally required to bring a vat to its normal temperature, and the apparatus, if made on the premises, should not cost more than £10.

The machine may be rendered more effective by using thin copper pipes tinned inside, but this greatly increases the cost.

The inside of the pipes can be easily cleaned by unfastening the pieces of hose and passing through each a rod made of ½-in. galvanized piping, with a rag secured at one end. By giving a fall of about 1 inch to the whole system, the cleaning and draining at the close of each operation will be rendered much easier.

What should we add to the Must to make a First-class Wine?—Can we Reduce Must very rich in Sugar by the addition of Water?

Judging by letters received from wine-makers, they seem to be under the impression that they ought "to put as many things as possible" in the vat to make a good wine; this is a regrettable tenuency, unwarranted in the case of a normally ripe crop fermenting under good conditions. The addition of chemicals to the must should only be the exception.

When the red grapes are of sound quality and gathered at the right time, *i.e.*, neither too green nor too ripe, the best way of obtaining a sound wine is to "add nothing." Grapes gathered under these

conditions contain all the required matters for a regular fermentation, and no addition (except, perhaps, pure yeast) could increase its quality, and it might, if not made with good judgment, spoil it.

The use of adjuncts only becomes necessary, in the case of inferior must, due to a defect in ripeness, over-ripeness, cryptogamic diseases, want of tannin, &c.

Want of Ripeness.

This produces a deficiency in sugar, and an excess of acid. There is no lawful process of diminishing the acidity of must. However, this is only a slight drawback, acid* wines being required for blending purposes. Formerly the addition of water and sugar in varying proportions (Gallization) was resorted to, but it is now forbidden by law.

The only lawful means left is blending with over-ripe grapes, when possible.

Over-ripeness.

This defect, which is frequent in the hot districts of the Murray, could often be avoided by gathering the grapes earlier. However, this is not always possible on large vineyards where sufficient manual labour is not generally procurable. We may also remind the reader that Roos, the Director of the Œnologic Station of the Hérault, advises gathering the grapes at full maturity and, if necessary, adding tartaric acid. Some authorities advocated the addition of water and acid to the must of over-ripe grapes. This practice might give favorable results in hot districts, but the Act of 1890 forbids it.

The acidification of must may be done with tartaric acid by using increasing proportions of the acid as the grapes become riper, starting from 20 grains per gallon of wine, and gradually increasing to about three times that amount. If it be desired to operate more accurately, "acidimetres"† or "calcimetres" should be employed.

When we know the Acid contained in our Must, how are we to know the Quantity of Tartaric Acid to add?

The quantity will depend on the variety cultivated and the type of wine required. It is generally considered that a light claret should contain 560 grains of acid per gallon (reckoned as tartaric acid). If the must only contains 250 grains, which is generally the case in the Murray districts, one should add 310 grains per gallon and so forth.

The addition of gypsum (sulphate of lime) or phosphate of lime, may also be found useful. But these two chemicals are more specially required in the case of an inferior crop resulting from

Cryptogamic Diseases and unfavorable Season.

It is most important in this case to "correct the nature of the must" by restoring the balance between the constituent parts of the grape, and by taking necessary precautions to insure clarifying.

* This should not be confounded with acetic wine containing vinegar.

† See *Agricultural Journal*, page 182.

The first necessity is to restore the normal acidity by the addition of a sufficient quantity of tartaric acid, for one should bear in mind that whilst it is unnecessary to add anything to a normal crop, it is equally necessary to add certain chemicals to must known to be lacking in certain elements.

Plaster may be used together with tartaric acid, as it helps in clarifying. But we must remember that the use of sulphate of lime is regulated by law,* and that wines containing more than 140 grains of potassium sulphate per gallon cannot be offered for sale. We know that many wines naturally contain small quantities of potassium sulphate; and that sulphurous acid, resulting from the combustion of sulphur, produces it. We should, therefore, to be within the law, measure very carefully the quantity of plaster to be added.

It should never be more than 42 oz. per ton of grapes, and even then it would be advisable to make one or two vats without plaster so as to be able to blend, in case of overstepping the limit allowed by law.

Deficiency in Tannin.

This is rare with red grapes, but we may say that all Victorian white wines are deficient in tannin, and this accounts for the cloudiness of certain white wines, which never become bright. If we try to fine them in the ordinary way, we see that the fining remains in suspension in the liquid, instead of settling at the bottom. The reason is that there is not enough tannin to coagulate the albumen (fining) and precipitate it to the bottom of the cask. The measurement of tannic acid in the must is a delicate operation, which cannot be performed by most viticulturists, as in the case of acid or sugar. But it is considered, as a rule, that 7 to 10 grains of tannic acid per gallon are required for white wines.

If the tannin is not added before fermentation, it has to be added later on, when one wishes to fine a cloudy wine.

In conclusion, we must draw attention to two accidents generally attending the manufacture of white wine. It has been noticed that such wines often turn yellowish or blackish. The yellow colour—due to too great an aeration (oxydation)—may be prevented (1) by not allowing the grapes to remain a long time in the press—for this reason continuous presses are better than ordinary screw presses—and (2) by avoiding, as far as possible, contact with air during racking. Racking in lightly sulphured hogsheads may also be found useful. Nothing else has been found effective except perhaps carbonication, a process which has not yet become very practical.

The blackening, which is a kind of "cass," is a much more serious evil. Sulphurous or tartaric acid does not always succeed in removing it. Robinet and Maugin† have long and successfully used citric acid as a preventive against blackening. They use from 30 to 60 grains per gallon. Half is added to the must as a means of prevention, the other half to the wine if it shows any tendency to blacken.

* An Act to prevent the adulteration of wine (17 Oct., 1900) [Clause 6].

† *Journal d'Agriculture pratique.*

Is the use of citric acid illegal? It certainly does not exist naturally in wine, like tartaric acid. On the other hand, it is not more injurious to health than lemon, which contains it. It is not objected to in the shape of lemonades, or lemon squashes, which are far more concentrated, and therefore might be tolerated on the same score as tartaric acid. We do not know that the question has ever been raised.

One may succeed in preventing a white wine from blackening by strongly aerating it, racking it several times, or better still, by forcing air through it. This causes the black matter to precipitate, and with the help of fining it may be got rid of; but we must not forget that aeration causes white wines to become yellow. From this point of view the citric acid treatment is certainly superior.

SEASONABLE WORK IN THE CELLAR AND VINEYARD.

By R. Dubois, B.Sc.

March.

Cellar.

Wine-making is in full swing. Follow advice given in the January and February issues. Clean cellar appliances, if this has not already been done. Old wines do not require as much care as during February, but they should be examined, and those showing any sign of turning racked in sulphured hogsheads.

Vineyard.

Although all hands available on the farm are required for the vintage, do not forget to hoe the nursery of American vines, as where there is no mulch it is important to keep the surface loose. Select the scions required for next season's grafting from fruit-bearing shoots, and mark each with a piece of tape. If you notice any mixture in your nursery, mark the strangers, so as to be able to remove them when lifting. Remove the bottom leaves from late varieties not ripening easily. This applies chiefly to vineyards south of the Dividing Range.

HORTICULTURAL BRANCH.

SCHOOL OF HORTICULTURE, BURNLEY.

C. Bogue Luffmann.

Reconstituting Old Orchard and Garden Land.

What are known as light soils give out first under regular cultivation.

The depth and character of a soil, together with the climate and amount of water acting upon it, determine its manurial requirements for a particular crop or group of plants.

Old orchard and garden land which has become poor is invariably sweet, and will endure heavy dressings of spent manure, new top spit earth, ashes, and lime. Drains want relaying before making up the soil, and all irregularities graded out so that a perfect balance is secured to all the surface. The most untidy old orchard or garden holds the largest amount of material for re-making, as the litter is so much valuable stuff out of place.

When closely planted and overgrown, hard pruning and thinning precede any work on the soil, as by adding light, air, cleansing winds, and more heat, great activity will take place in the native earth, even though it be poor and insufficient.

In practice, many old orchards and gardens cannot be refurnished with complete soil in a single operation or season. The amount of material or money available is limited, so that the work has to be done in sections: or, in the event of a several inch layer being required, this may be too much at once to place over roots, and the material will have to be given at intervals of six or twelve months.

For flower gardens one must be continually deepening, and working to sweeten the soil.

The vegetable garden must be regularly supplied with strong manure, trenched or subsoiled every few years, and so drained, laid out, and worked that abundant air, moisture, and plant food may be available at all seasons.

The orchard should be composed of deep, free, and composite soil. Any neglect, or the application of any material which causes sourness, acts directly against perfect growth and the development of flower and fruit. Orchard lands want deepening and enriching by every possible means, not only in order to increase the food supply, but more particularly to retain moisture in summer, when so many trees are liable to suffer to the extent that they yield inferior crops and decline prematurely. Subsoiling or hand trenching may be done to advantage where no large additions can be made in the form of manure or new soil. Heavy and adhesive subsoils may not be brought to the surface, nor is it often advisable to disturb such material, unless some loosening elements such as ashes, gravel, or sand can be mixed in.

In rich deep soils the sublayers rapidly become sour unless drainage is absolutely perfect, and here deep cultivating and exposure to air make a large amount of food available, without the addition of any new material excepting lime. By deepening the furrows of orchard land sufficient soil is obtained to cover bare roots, which are liable to be rendered useless by exposure to the sun's rays and the presence of air.

Surface drainage becomes faulty as orchards age, and deeper ditches or roads have to be made in order to keep the surface favorable to the requirements of the trees. He who handles much soil and manure also finds pleasure in handling heavy crops of fruit.

In the kitchen garden, any shrinkage or insufficient depth of soil is first to be met by carting in top spit earth or turf skimmings from the oldest available pasture, the more fibrous the better. To this add as much manure as will secure a free moisture holding loam, and arrange the levels so as to secure perfect surface and under drainage, with means to alter the depth and temperature of beds at will; otherwise it will be a garden at particular seasons instead of all the year round.

When the flower garden land gives out, the area is almost certain to stand in need of replanning. Only a path or two may require removal to change the whole aspect and character of the place. A bank may be cut down or lengthened, or a mound or barrier thrown up where the existing soil and level prove unsuitable for generous growth or good effect. Everything must be done to improve the shape and make the new levels serve to fuller purpose than the old. Where no soil is available from without, and the garden is unequal in quality and position, distinct treatment should be given to the various parts, so that groups may be formed for each; those needing most food and protection getting the generous and sheltered position, rock plants, the hungry and exposed section, and distinctly hardy shrubs and flowers the medium position.

To put a 3-inch dressing of new earth over an acre costs at least £10, even if the material is obtainable close by and for nothing. This would be an insignificant dressing for a really poor and shallow soil. To give a suitable dressing of lime costs from £2 10s. to £4 per acre, according to soil wants and freight charges involved. The making and application of 100 loads of manure costs about £10.

Chemical manures do not add to depth, moisture, or heat-holding capacity of soils, nor do they assist aeration to any appreciable extent. They are literally stimulants, and should not be relied on to make soil. Bone-dust, blood manure, sweepings and cuttings from abattoirs and boiling-down establishments, street sweepings, and soot are the best available materials for adding the chemical necessities to plants from the soil; but more bulk must be provided by additions of n w earth, or deeper working of the old. Autumn and winter are the seasons for deepening, heavy manuring, re-draining, and re-casting surface soil. Green manuring is appropriate only to large orchards and open lands previous to planting. By humus, greater moisture-holding power, more friable soil, and lower summer temperature is secured. This subject is a most important one for the orchardist and gardener, and a special article will be devoted to it in an early issue.

Watering in Late Summer.

This is often productive of serious results, in that it spoils such buds as may be desired for immediate fruiting.

It requires genuine experience of trees under particular conditions before they can be irrigated with safety in late summer. The ordinary reason for summer watering is to swell the fruit. This it undoubtedly does, but the increased size may be purchased at too great cost. With such trees as strong apples, pears, and plums, it is almost certain that they will make no show of flavour, or at least none which will set and sustain fruit in a season after heavy late summer watering. If the ground dries out quickly afterwards, no serious harm may be done, but should it remain moist and start a wood growth, the loss of fruit must be in something like exact proportion to the new shoots appearing on all weak and lateral wood. Buds wait for food and temperature to determine what they shall be, and normally the ripe buds of autumn are flower, but if they are fed they start out as wood buds, and have not time to ripen any buds their new leaves may furnish before the fall.

The Keeping Quality of Fruits.

Fruit does not form or keep well when sharp contrasts in the climate occur during the different stages of growth. So noticeable is this that fruits gathered from different parts of a tree have different degrees of sweetness, acidity, substance of skin, amount of moisture, and air space at the core. Consequently, the keeping quality varies in accordance with the physical and chemical condition. Fruit grown in deep shade rarely attains to full perfection, nor will it bear friction in transit or keep well if stored, owing to its holding a high percentage of moisture and being coarse yet weak in structure. On the other hand, fruit much exposed to direct sunlight is, in a hot climate, liable to stop growing prematurely, to be blistered and scalded, at which spots disease occurs through the ingress of air. Fruit which can throw off moisture readily through its skin, and developes a tough or wrinkled surface, keeps better than such as preserves a smooth and distended surface.

When the temperature rises so high that the roots and leaves are powerless to assimilate the food elements in their right proportion the fruit suffers.

By way of illustration, the soft-shelled egg may be instanced. This is due to the absence of lime in the fowl's diet. In the same way, the plant depending on incomplete sap can make no perfect fruit. The cell walls are so thin that under the pressure of the circulating sap, and of the expansion of the moisture, due to solar heat, they burst and the contents of the various cells run together. "Water Core" and other unclassified maladies of the apple, pear, and plum are largely due to this overheating of the sap, imperfect feeding, and the rupturing or death of certain cells. Any internal flaws or looseness in growth have a most decided effect on the keeping qualities of fruit.

The lesson to be learned is in two divisions. We have (1) to increase the depth and thereby decrease the summer temperature of the soil ; and (2) to provide thick-barked, strong-limbed, hardy-leaved, and broad-based self-protecting varieties of hard fruits so as to shield them as much as possible against an adverse summer climate.

BRIEF STUDIES IN THE ORCHARD AND GARDEN.

By C. Bogue Luffmann.

I. Soil sickness and plant excrement.
II. Planting according to the stock used.
III. Growing and feeding.
IV. Fruit trees flowering out of season.
V. Causes of early and late ripening.
VI. Internal decay of fruits.
VII. Lime and its allies.
VIII. Stones cracking and irregularly-formed fruit.
IX. Nature of trees determined by their bark.
X. To increase the yield and quality of fruit.
XI. Selecting Strawberry runners.

Soil "Sickness" and Plant Excrement.

Orchardists and gardeners often complain of land being "sick" without giving any reason beyond stating that it has borne a given crop too long. This is in some measure true, as the constant absorption of certain elements must leave the ground poorer for succeeding crops or annual growths of roots of permanent trees. But the real sickness which makes land positively distasteful to a subject, is not due to any element it lacks, but to the presence of noxious matter which has been thrown off or affected by roots of the same species. All gases, acids, and solids thrown off by any vegetable as by any animal, are a class of filth which it has no capacity to reimbibe or utilize. Plant excrement is something to be reckoned with in the preparation and cultivation of land, and unless manure of the right class—such as will change the unwholesome into sweet and useful food—and free exposure to air be given, that the impurities may be changed or pass away, the soil will remain "sick" and valueless.

Planting According to the "Stock" Used.

As no fruit trees come true from seed, and for various other reasons, all are of necessity placed on stocks of some kind or another.

Trees are "worked" high or low according to the ability of the operator and the demands of the purchaser, neither of whom may be said to be usually right in his judgment. Whatever the length or nature of the stock, the resulting tree will be affected very much by the way in which it is planted. Some stocks require to be buried outright, therefore they should always be worked very low; others will not survive if the bud or graft union is not kept well above the surface of the ground.

As a standing rule no stock should be buried if it is given to gumming; thus citrus, cherry, apricot, and peach should always be planted with an inch or two at least of the stock above the ground. When the plum is placed on its own stock it is often advisable to bury it, especially where the stock is hard and close in the bark. The quince, when used as stock for the pear, should always be buried, otherwise it makes a cankerous and weakly trunk, which seriously affects the life and value of the tree. White thorn, not much used, but if employed as a stock should always be buried, and that deeply, or it promotes a

scaly trunk and suckers very badly. Some may object that burying the stock will cause such as pears to send out roots of themselves, but this is no serious matter, for it can occur only whilst the tree is young, and they are then easily removed.

Growing and Feeding.

The average orchardist makes no fine distinction between the growing and feeding powers of a tree, hence his treatment is often just the opposite of what it should be for a particular object. Concerning our deciduous fruit trees, their roots expand and extend during moist cool weather; make fibrils and feed their leaves during warm moist weather; flower buds form and develop in a warm dry soil and atmosphere; fruits grow in a warm moist soil and atmosphere; fruits ripen in a warm dry atmosphere; leaves perfect themselves in autumn and thereby secure healthy wood and fruit buds for future use when the soil is dry and light, and air circulates freely.

Fruit Trees Flowering Out of Season.

Deciduous trees frequently flower in autumn, and give rise to wonderment as to the cause. When it is considered that flower is—next to fruit—the final triumph of the plant, it is not remarkable that flower should occur whenever wood is sufficiently old and ripe to perfect flower buds. Locally, two growths occur in our summers as against one in the colder countries of the old world, spring and late summer both combining sufficient moisture and heat to make the roots active. The weak growth made in spring ripens during the hot midsummer, and bursts into flower in autumn. It is only where the trees grow so strong and so continuously as to prevent the early formation of flower buds that they pass into autumn in an undeveloped state, and are saved for the normal opening in the following spring. The vagaries of climate, placing in unnatural positions, defects in watering, cultivating, and pruning, are all more or less direct causes of trees flowering out of season. It is a misfortune which no skilful orchardist need experience, as, apart from a check as by lifting and replanting, flowers do not appear out of season when fruit tree management is well understood.

Causes of Early and Late Ripening.

Fruit borne on young trees, or on strong young wood, ripens later and keeps better than such as proceeds from old and weakly trees. This is owing to the sap being more complete and abundant, and sustaining the fruit till it reaches full size and perfection of quality. One of the most important objects of pruning is to promote a full supply of new wood from year to year, in order to get sound and handsome fruit such as healthy wood alone is able to give.

Internal Decay of Fruits.

Quite a number of causes go to provide this malady, which is not directly due to a disease, but comes from a physical defect in the fruit. Some apples remain so open, both at the eye and the stalk end, that the air passes freely into the heart and causes a mould to develop about

the pips. In such circumstances decay is swift and uncontrollable. An examination of peaches and plums decaying at the stone will reveal the same fact; air enters at the stalk end and provides the requisite chance for fungi to operate. Pears which rot at the core do so chiefly from their growing rapidly and secreting imperfect matter with air at their centre, which affects and causes the decay of the surrounding fruity matter. The shape, season of ripening, nature of climate, and the quality of the soil all play important parts in promoting or preventing core rot and internal decay of any kind.

Lime and Its Allies.

Lime, marl, gypsum, sea-shells, chalk, or bone meal should be regularly applied to orchard lands in autumn, in order to keep trees strong, and that the food stuffs may be set free and sourness prevented.

Stones Cracking and Irregularly-formed Stone Fruits.

Incomplete soil, injury to bark, and general debility in trees are responsible for these defects. Lime—almost everywhere a scarce quantity in Victoria—is particularly necessary to stone fruits. Its absence gives rise to small and unsound stones, which split and cause decay or, the fruit powerless to expand, admits of no developments on the weakly side. The reason for fruit being so much stronger on one side than the other is largely due to the sap flowing more freely on a particular side of the wood supporting the fruit. In the case of plums they are frequently "struck" by a cold blast when young and sensitive. This has the effect of withering, but not actually destroying a part, so that only a proportion developing properly gives a lop-sided form to the fruit.

The Nature of Fruit Trees Determined by their Bark.

The substance and character of bark goes far to decide the strength of any tree and its capacity for resisting heat and cold. Smooth hard barks *invariably mean weakly trees, sensitive to heat, therefore they* should not be selected for planting in hot districts. Thick down-covered bark *is to be sought in apples for hot and shallow soils.* The smooth-surfaced and thin barks have a greater capacity for standing cold than heat, *and prove most suitable for planting in deep rich soils,* as owing to the limited amount of sap they carry the tree matures *early and fruits freely, where a coarse-barked variety would run all to* wood. Apples, plums, pears, and cherries are most affected by the *substance and sensitiveness of their bark, but there is no species of* fruit which it will not pay to consider in this particular, in order to *insure the most appropriate growth for a given area.*

To Increase the Average Yield and Quality of our Fruit.

(1) We must thoroughly understand the appropriate shape, size, *and substance of the framework of the tree under a given set of* conditions; (2) regularly prune out all weak and exhausted wood so *as to prevent* the appearance of inferior fruit, and secure bold, well

developed specimens from young and healthy wood ; (3) cultivate in strict accord with the nature of the season and condition of the tree ; (4) feed or retard growth so as to obtain just such quantity and size in the leaves as will give the desired amount of food for the furtherance of the tree as a whole, and the making of flower buds and fruit ; (5) reduce the size of the tree : and (6) increase the size of the fruiting wood as the tree ages : (7) we must prune according to our knowledge. Only those who can accurately account for every cut made on a tree may deal with all the details of pruning with success. Failing this knowledge it is better to feed the soil with good manure, drain, and sweeten it, keep it well cultivated, and do no more than branch prune, that is, in winter thin out such branches as are crowding each other and shutting out light and air ; (8) the root system must in all hot and shallow soils be as deep as possible that feeding may continue during mid and late summer.

Selecting Strawberry Runners.

The strawberry plant is liable to yield an exceptionally large percentage of runners which prove entirely impotent, or bear but very little fruit. This variation in productivity is due to lack of maturation of the sap, through inequalities in the food supply and the vagaries of the season. Normally, runners made in a dry season are more fruitful than those which push out and are fed for a considerable period by strong parent plants. It takes a mature parent to furnish a fruitful runner. This explains why the first runners, or those connected directly with the parent, prove more reliable than such as proceed from the immature runners. Runners made in early and late summer, are, locally, of more value than such as start in spring or autumn. The former are usually too strong and the latter too weak to be of value. The runner of most value is of medium strength, and has well-grown and fully-ripened leaves at the time of lifting in autumn.

THE ORCHARD.

March should see the bulk of the fruit gathered in, and either marketed or stored, after which some attention should be paid to the collecting and making of manure and such soil dressing as will prove of service to the particular area and trees it carries. It must be everlastingly appropriate to plead for and advise the manuring of our orchards. They are in a bad way, and it is useless to cloak the fact. Many complain that their locality holds no natural manures or other materials such as would dress and help the trees. If such is the case, there is conclusive proof that fruit trees should never have been planted. The orchard area of any district must in reason be in direct proportion to its food supply in the shape of manure. Thousands of tons of useful litter lie about the roads and "no man's lands" of most districts, and as soon as rain comes, and shovelling or scraping is a straightforward operation, advantage should be taken to cart as much as possible either into a pit like a shallow dam or direct to the orchard, where trees are languishing for the want of a richer and a deeper soil. In this month's notes the watering of trees in autumn is referred to. Keep the leaves sound, so that they experience a natural fall, but avoid promoting new ones, as if these appear in any quantity fruit will not be general next season. Strong trees will ripen their wood best if the soil remains close and hard during this month; but, apart from the cool, deep soils of the southern districts, it is inadvisable to neglect to cultivate in the late summer, as the common want is more robust growth, and this cannot occur if the roots need air and moisture. In ordinary circumstances it is too late to thin light and excessive wood, but since all our care at this season is directed towards perfecting and ripening of the wood and developing flower buds, any admission of light, sun heat, and air will have a good effect. Budding may be done in the far north or wherever the sap is moving freely, and the leaves retain their natural colour. Burn all surface litter on new orchard land, or such as adjoins existing orchards, before the summer breaks up, otherwise a lot of filth will remain to sour the soil and spread disease. A light ploughing where possible will secure the admission of any rain which falls, and allow of a good deep working in early autumn. This is usually much to be desired, as when the leaves decline the roots become active, and if a free, deep, and sweet body of earth exists they will feed and grow apace, with the result that an abundant head-growth will form in the following summer, and all fruit be of fine quality.

TABLE AND RAISIN GRAPES.

This is the grape month, but February should see a far larger quantity of fruit, and it might easily be made to do so by altering the design of the vine, controlling its root range, more systematic irrigating and cultivating, and by judicious thinning and stopping during summer. As things are the fruit comes and goes by chance, with the result that few reap anything like a fine harvest from the crop. Table grapes decline in value as the days shorten and become cold, so that it will be necessary to keep the fruit and the soil well exposed in order that all available heat may be employed in steadying the flow of sap, and inducing early ripening. The nearer fruit is borne to the ground the sooner it ripens, and the more flavour it possesses. Table grapes should never be so placed on the shoots that they wave in the wind or sweep the ground. Good winter pruning and skilful thinning and tieing in early summer, give each branch a firm and fixed position, where it remains open on all sides to receive such uniform supplies of heat, air, and light as renders it perfect in every grain. Raisin-growers in the central districts should early pick off such leaves and shoots as surround and obscure the fruit. Only ripe grapes can by any manner of means make good raisins. So long as the stalk remains green the grapes are feeding and immature. All fruit must be at least partially dried and well coloured in the open air before transferring it to the kiln. Such stuff as is dipped and placed dripping wet in kilns does not make anything worthy of the name of a raisin, though it goes a long way towards keeping down prices, and giving the foreign article a chance to compete against us.

THE VEGETABLE GARDEN.

To grow good vegetables in variety in a warm climate deep digging, plenty of manure, frequent watering, and thorough cultivation are all indispensable. In winter the firmer and more shallow the soil, the more heat it attracts and retains. Therefore certain vegetables which are sensitive to cold will thrive in poor soils better than where it is rich and wet. There are few parts of Victoria where good vegetables may not be produced at a reasonable outlay during autumn, winter, and spring. During this month land should receive a good dressing of manure, and if loose enough dig into bold beds or strips that the weather may act on and fine it down. Cabbages and cauliflowers may be set out wherever the soil is moist and facilities exist for giving water. If severe frosts do not occur in early autumn French beans may be sown early in the month; also carrots, lettuce, spinach, and silver beet. Thin the foliage and fruit of tomatoes which are growing strong, and take any weeds from the soil which are liable to keep it damp and cool. Celery for spring use may be set out, giving it a deep or shallow trench according as the soil is poor or comparatively rich and cold. Turnips may be sown if there is a certainty of plenty of water; failing this, wait for the soil to become well wetted, then give a good manuring, and force into edible size as quickly as possible.

THE HARDY FLOWER GARDEN.

North of the Divide, or wherever soil is shallow and dry, a good autumn and early winter show of flowers may be secured if the soil is well managed and additional planting done during this month. Cuttings and divisions of herbaceous plants may be set out in a rich, sweet, and well-watered bed, or, in the case of their being strong and hardy, planted in permanent quarters. The gardener must regularly look ahead if he would have neat and pleasing surroundings at all seasons. Put in any bulbs which are available to a depth in accord with their size and the character of the soil. The looser and more sandy, the deeper should bulbs and seeds be sown. Seeds as a rule are planted far too deep, whilst bulbs as often suffer from being placed too near the surface. The holes for the reception of bulbs should be about three times their length—thus a bulb two inches long will be covered by four inches of soil. A lot of extra bloom and bright foliage may be induced to appear during the next two months where roses and other flowering plants are judiciously thinned and stopped in March. Some are so inexperienced as to get flowers and bright fresh leaves over but a few months of the year ; but these are not gardeners, the capable and industrious securing a profusion of flowers, foliage plants, and deciduous trees in attractive guise the year round. Where lawns have suffered from drought or hard wear, give a half-inch dressing of mellow soil or old manure, then water or wait for rain. Weeds should always be removed from grass before they seed or run riot through the mass. Everything should be done to get the grass growing early this month, that it may be mown and dressed in time to wear a rich and even tone during autumn and winter. To have well finished lawns when shrubberies or borders look sombre or bare is to secure as much for the eye as will make the garden a homely and habitable place. The grape vine is one of the most effective of garden plants, if a good choice of position is made and the foliage kept sufficiently open to admit of its taking on good colours in autumn. If leaves grow in shade they will fall early and wear nothing more attractive than a sickly yellow. But vines grown in somewhat hard soils and warm aspects develop colour in their leaves two or three months before the fall, hence a most pleasing addition can be made to many a spot which is liable to be counted good for nothing. In the southern and more favorable districts the main concern is to keep the garden full of beauty, and to prevent the appearance of bare gaps or hard lines of colour. Masses are pleasing, where lines prove wearisome and unsightly. A formal garden must needs have rows and regularity here and there, but the formal garden is rarely desirable in Victoria (or in any other part of Australia) and as much variety of scene and natural form as can be shown, without overdoing it, will give the greatest satisfaction to the beholder. Now is a good time to decide on alterations to be carried out in winter. Whilst the garden is carrying its full supply of foliage and flowers, defects in size and arrangement are easily detected. Trees, buildings, or boundary lines may need

improving out of sight or partly covering. Borders and beds, if never altered, make all the years the same, and life seem very short, compared with all that may be obtained by steadily altering and improving the plan. This is the curse of so much local work; it is all brown and barren, and never any substantial and effective change. An air of age and dignity may obtain in the flower garden, even though it be refashioned wholly or in part from year to year. Certain it is that the foundation of good gardens have yet to be laid, and that gardening will be comparatively expensive and unprofitable till more consideration is given to the true meaning and value of the garden under local conditions of climate.

THE SPRAYING AND CLEANING OF FRUIT TREES.

By A. G. Campbell.

At this season of the year there is neither the necessity nor the opportunity for extensive spraying locally. The diseases appearing in spring—aphis and leaf-curl, pear mite, and apple scab—have more or less done their work for the time, and are now prepared, or are preparing, for their dormant stages in which to pass the winter. So no benefit will result to this season's growth of wood and fruit by spraying now; and, besides, the mixtures cannot be used at their full strength while the trees are in foliage.

But, nevertheless, much good could be done even now by the enterprising orchardist, could the required amount of time and labour be profitably taken away from the more important operations of harvesting and marketing, which are demanding attention at this season. Diseases may be checked or prevented from appearing next season, and indirectly the fruiting wood of a tree may be materially benefited by spraying at this time of the year.

The codlin moth is the pest which is perhaps occupying most attention at present.

The placing of a hessian bandage around the trunk of each apple and pear tree is an excellent means of inducing the codlin larvæ to spin their cocoons within a small area, which can be overhauled and cleaned in a few minutes. But unbandaged trees, with the cocoons spun in various protected positions all over the trunk and branches, are a certain menace to a whole orchard or district.

At this central station, or in any district with a similar climate, the codlin moth bandages need only be cleaned and renewed once a year, for we know that, when the full-grown larvæ leave the fruit in December and January, and spin under the bagging, they will remain there and not hatch out until the following spring. When overhauling the bandages during the second week in February several empty chrysalids will be found. This shows that some grubs did hatch this season. But in warmer districts, unfortunately, the pest will only remain in the cocoon about a fortnight, sufficient time for it to change to the moth stage again, and it emerges to lay a fresh lot of eggs the same season. In localities where the second brood is known, the bandages must be examined frequently; in fact, not more than twelve days should elapse without a thorough cleaning being given.

The value of spraying for the codlin moth is now being recognised, and Paris green, applied to the small fruits at the time when the young newly-hatched larvæ are crawling about seeking some protected position in which to commence work, no doubt poisons a great number. Spraying the fruit again several times in December, when the second brood is due, would also prove beneficial. But it is more than likely that the larvæ, which seek an entrance into fruit and which has grown some size, find it very difficult. It is easily noticed how readily they

make use of protection where a leaf overlies the fruit, or where one fruit touches another. The hailstorm of 14th November, 1901, caused many scars, which, although so late in the season, provided shelter for many codlin larvæ. This leads to the belief that where no such damage occurs, the young codlin must die in considerable numbers from exposure.

The woolly aphis of the apple tree is noticed to decrease in numbers as the hot weather comes round, but in sheltered positions, it is still in evidence. Spraying is never very effective with this pest, because the white downy covering which the insect possesses is an efficient protection against moisture in any form. Bordeaux paint, applied with a brush to the affected portions, is the better remedy.

Although the aphis has practically done all the harm it can do this season to the older branches, on which such unsightly galls are raised, yet it is not advisable to let the aphis remain on the trees. If undisturbed, they will, naturally, have a greater opportunity of distributing themselves over the orchard before they finally go into winter quarters, and this is more to be feared at this time of the year than the mere increase of numbers.

Besides the codlin and the woolly aphis on the apples, we have the dreaded black scab, or black spot, to contend with. This is the result of a fungus growth which destroys the tissue of the fruit, and then covers the surface of the scab with a deep olive-coloured mould. This is one of the stages at which the disease should be combated if possible, for this mouldy coat is composed of myriads of minute spores, which are easily shaken or rubbed off. They fall to the ground and hide in old leaves and rubbish, or find their way into crevices of the bark, and there remain till next spring.

Besides attacking the fruit, the black scab is also found on the leaves of apple trees in the form of round or irregular spots. These increase in size, and often run together. The same remarks made about the black scab of the apple will apply to the black scab or spot of pear, which is almost identical.

All badly-infected fruits must be destroyed; there is no surer method than to burn them. To place such fruit in cases, and send them off the premises, means that both fruit and cases will be a source of infection wherever they go.

The strong winter spraying with Bordeaux goes a long way toward checking the scab in the orchard. Then, where the disease is bad, a second spraying in spring with the half strength, after the fruit has set, would be of benefit in seconding the results of the winter spray, and especially in preventing the growth of the fungus on the leaves, which really serve as a propagating ground for the pest.

Sometimes, in spite of all precautions, the scab will be found in summer in considerable quantities. Now, if the orchardist values next season's crop of fruit, or the attention already given to the trees, he will not allow these spots to produce spores unchecked. Bordeaux mixture should again be used. When spraying during spring or summer, this mixture is made with twice the quantity of water, so that there is no danger of injuring the leaves and young shoots.

From the peach trees both the aphis and the leaf-curl have now disappeared, but to be out of sight should not mean, for them, to be out of mind. For now the unmistakable evidences of both pests can be seen, if not in distorted shoots and leaves, then in the mass of small tender shoots which generally appear after bad attacks. These are, of course, "second growth," and in many cases, unless thinned and encouraged to grow strong, would not carry fruit buds for next season's crop of fruit.

When the tree is at this stage of weakness it is often found that the peach-leaf rust attacks it, and preys upon the leaves, thus further retarding the proper development of the fruiting shoots. This can be avoided by strengthening the tree at the roots, irrigating, and feeding it, and by spraying the head with a weak solution of Bordeaux to kill the fungus plants as soon as the yellow spots or blotches appear; for the rust, like the leaf-curl, is caused by a fungus, although not the same variety. The leaf-curl pounces on the young leaves when they unroll from the bud in spring, and by the end of October has run its course and disappeared. But during the greater part of its existence it has been producing millions of spores, which will be inactive until the buds burst again next spring.

The peach leaf rust is content to appear later in the season, and prey upon older leaves which are becoming sickly from various causes. But the rust, none the less, saps the tree of much strength.

In spraying peach trees in spring when the foliage is tender, it is found necessary to dilute the Bordeaux mixture to even less than half strength, for the peach leaves are not as strong in constitution as those of other fruit trees. But later the mixture may be used at half or summer strength.

Although winter is the best time for spraying, because the mixtures can be used so much stronger when there is no foliage on the trees, yet much good results from a summer spraying, if properly done, because the spores of fungi are more or less in a young and fresh state, and have not prepared themselves for the winter by assuming heavy coats and coverings. Further, they are lying about on the surfaces of the leaves and bark, or even in the crevices of the latter. They have not yet become covered with grit and dust, or over-grown with mosses. So even the weakened mixture can do its work well by coming into direct contact with these minute spores.

Bordeaux mixture is undoubtedly the best fungicide we have, and when skilfully applied, will prove one of the orchardist's best friends.

THE TOBACCO INDUSTRY.

Advice to Tobacco-growers on Priming and Topping Tobacco.

By Temple A. J. Smith.

As the season for topping tobacco is now at hand a few hints on this question should be of value to tobacco producers.

All growers realize that it pays better to produce leaf worth 6d. per lb. than to grow leaf worth only 2d., and the way to obtain the better price for the bulk of the crop depends largely upon proper methods of topping and priming.

The habit generally followed by the Victorian has been to allow too many leaves to mature upon the plant—in cases as many as 25 leaves. This is a great error, and the following reasons will appeal to the grower in support of the contention that priming high, and topping low will give the best results. It has been found by practical experience in America that the maximum number of leaves should not exceed 14, and the same rule should apply here.

Most growers are aware that the five or six bottom leaves are of inferior quality to the middle leaves. They are generally more worm-eaten, are always dirtier, and become frayed and bruised by constant rubbing on the ground. They are taking the nutriment that should go to the middle and best leaves, which bring the best prices, while they themselves are worth little or nothing. They should therefore be removed when the plant is a foot to eighteen inches high, and the earth hilled up well round the stem. The topmost leaves are generally narrower and smaller. They do not make the best wrappers, and also take from the good leaves a certain amount of nourishment. They should be nipped back when the flower bud appears, leaving not more than 14 leaves on a large healthy plant, with a lesser number on smaller and backward plants. By following this system the crop will ripen more uniformly, and the bulk will be good tobacco with a minimum quantity of inferior.

Less work will be entailed, as a plant with 25 leaves, when topped, will grow 25 suckers, and they will be harder to find; therefore, nearly half the suckering will be saved where only 14 leaves are left. Then, again, when the plant with 25 leaves is hung up to dry in the shed the inner or middle leaves have a poor chance of drying well, as they are so clothed round with the bottom leaves the air cannot reach them freely, and they run great risk of mildew and poleburn, while the inferior bottom leaf is getting the advantage the good leaf is losing. When stripping and grading time comes, labour again is doubled when too many leaves are on the plant. Nearly twice the number of leaves have to be taken off and tied into bundles, and grading will take more than double the attention if properly done. The packing will take considerably more time, and freight will be paid on the cheap stuff at the same rate as on the good.

The yield per acre will not be affected by having a smaller number of leaves, as the smaller number will absorb the nourishment that would otherwise go to the inferior leaves, and the result will be a good gummy tobacco, containing a greater amount of nicotine, instead of a light papery leaf. The satisfaction alone of handling a good tobacco will go a long way with the grower in inducing him to follow the system advocated, and when he also finds that by growing the improved American varieties such as the *Conqueror*, on which the leaves grow fully twice the distance apart on the stem, thus enabling him to reach the suckers and discover the grubs more easily, and by following the more enlightened methods of cultivation and treatment generally the work is actually less and the pay better, he will increase his tobacco patch and his income at the same time.

POULTRY AS AN ADJUNCT TO THE FARM.

Hints to Beginners.

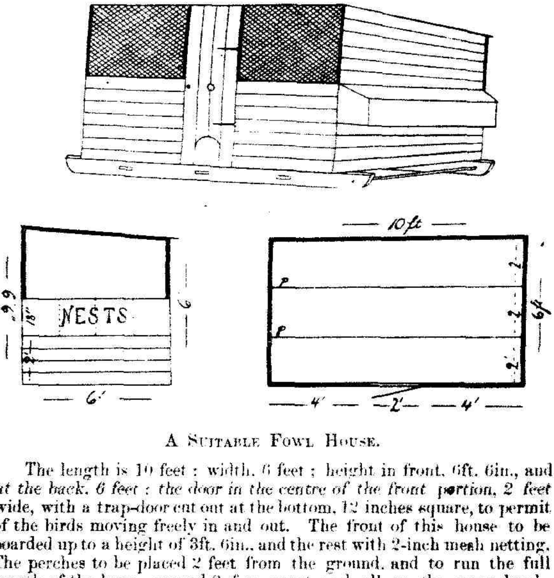
By A. Hart.

The profitable returns attached to an intelligent system of poultry-raising renders this subject one of interest to every farmer in the State. There doubtless exists an unlimited market for eggs in England, which is largely supplied by France, Italy, and Russia at present: but the fact that these countries can only supply England during the spring and summer months throws open this highly-profitable market during the cold weather to the poultry farmers of Australia. Advantage has not, so far, been taken of this excellent opportunity to its fullest extent. There can be no question about the value of the export trade in poultry under the guiding influence of the Department of Agriculture. Already this season over 120,000 birds have been graded and packed for the export trade. This is encouraging, and more so when it has to be remembered that poultry this season has ranged in price from 1s. to 1s. 6d. per pair higher than any season since this trade was inaugurated by the Department. With prevailing prices it is found a difficult task to complete existing orders. At the present rate of production it will take two years to fill the orders already in hand. These facts are mentioned simply to show that there is ample scope for increased attention being given by those who are favorably situated to take a part in this lucrative and interesting phase of farm life. It is a pleasure to note the steady improvement yearly taking place in the quality of the poultry sent to the Depôt for export. This has already had the effect of attracting buyers. When we consider that England alone paid last year £6,000,000 sterling for poultry, and this demand steadily increases, there can be no doubt as to the stability and profitable nature of the trade.

With the vast areas of unoccupied lands, cheap feed, splendid soil and climate, our producers have natural facilities such as are rarely, if ever, equalled in any part of the world.

I do not hesitate to urge every farmer in the State to turn his serious attention to this means of augmenting his income. As in other pursuits, competition demands an up-to-date knowledge of the industry in all its phases. Old habits and methods have to be abandoned to keep pace with modern requirements. An open mind must ever be encouraged to receive hints and acquire useful information. The best returns can only be secured by a wise selection of stock, judicious breeding, feeding, and studious attention to all the details of poultry management. The obsolete system of allowing the birds to roost in a tree or driven from the barn door with a pitchfork, and allowed to lay in a hedge, will not add to the profits.

Healthy surroundings and suitable shelter can only be provided by properly built and equipped fowl houses and yards. These may be erected at a nominal cost, and the following will act as a guide in erecting them :—



A SUITABLE FOWL HOUSE.

The length is 10 feet; width, 6 feet; height in front, 6ft. 6in., and *at the back, 6 feet; the door in the centre of the front portion, 2 feet* wide, with a trap-door cut out at the bottom, 12 inches square, to permit of the birds moving freely in and out. The front of this house to be boarded up to a height of 3ft. 6in., and the rest with 2-inch mesh netting. The perches to be placed 2 feet from the ground, and to run the full length of the house, spaced 2 feet apart, and all on the same level; *2 inch x 1 inch battens will act very well, provided they* are stayed at proper intervals so as to prevent sagging. The roof is best constructed of corrugated iron.

SITE.

Select a site high and dry, naturally drained, and protected with as much shelter as it is possible to obtain. Above all, see that the front of the house faces the east.

If palings are employed see that a good lap is made to prevent draughts and allow for shrinkage. When the cold weather sets in it is advisable to have shutters made of lining boards to fit over the wire openings, as one of the principal points to increase the egg basket is to keep your fowls as warm as possible at night.

This structure will accommodate comfortably 25 birds. To gain the greatest advantage it is advisable to construct this house to make it portable and free from draughts, and without floor. The latter provides the sanitary benefit of clean ground, seeing the house can be readily moved, when needed, on to clean, sweet, healthy ground—a leading factor in successful poultry and egg raising. The fowl run should be not less than 100 feet long by 25 feet wide, and so situated as to afford ample shelter, and abundance of green feed. An open range will prove more conducive to success in the breeding season and insure fertile eggs. To avoid entering the fowl house through the doorway when collecting the eggs, it is a good plan to have the ends of the house opened 15 inches right across, at a distance of 2 feet from the ground—in fact, on a level with the perches. Egg-boxes should be constructed the width and ends of the house, partitioned off into four compartments, and hooked into the end of the building, with an open front to closely fit against the openings in the sides of the fowl house. The top of these nest-boxes should slope from the house to the back of the nest, so as to afford no lodgement for damp. Wood or iron ought to be used to full width and length of the nest, with a small hole made 6 inches from each end, and one in the middle, to allow of a length of wire to be run through them and act as hinges. This will make the nest and lid movable, and permit of the house and nests being limewashed at least once a month. This is most essential to maintain the health of the fowls, and to keep down vermin.

A batten 2 inches wide should be nailed to the lower edge of the front of the nest boxes to prevent the eggs rolling out. Each compartment should be provided with clean straw and a nest egg. Place a handful of tobacco sweepings in each nest to keep it free from vermin.

Selection of Stock.

For table purposes see that healthy matured young birds are purchased of the following varieties:—

For quickly maturing, hardy and good grubbers, the Buff Orpington is fast making a name for itself by its all-round excellence. It possesses good white legs and flesh of the right quality. It is a splendid autumn and winter layer. This type has steadily advanced in favour of late, and, if kept up to its existing standard, promises to meet all requirements as a table fowl.

Next is the Wyandotte, which is so much favoured in America, and admired for its rich, sweet flesh of good grain and texture. It is noted for its maturing qualities and flesh-producing properties at a very early stage. So marketable is this variety that it is within the reach of every householder in England and the United States to purchase them at eight to twelve weeks old, at a good price, as broiler chickens. At fourteen weeks old they should weigh 3 lbs. each, if properly fed and forced from the shell. Chickens this weight, marketable from 1st October to the end of December, will bring 5s. to 6s. per pair. This is the aim to breed for. Our chickens in the past on our local markets have been bred and reared in such a haphazard fashion, no selection in

breeding, careless or ignorant attention—in fact, left to take care of themselves—that the returns proved disheartening. A marked contrast can always be made between the old-fashioned way of raising poultry and the modern systems now being rapidly adopted. Given proper attention to breeding, selection, and feeding, then poultry-raising pays well. There is money in it.

The last breed I purpose mentioning is the Dorking, but so far this class has not been a success in our climate, *i.e.*, the pure-bred birds. To render them fit I recommend that they be crossed with the Houdan. To my mind it is a want of fresh blood; and, if a few importations were made of healthy young stock, I feel certain that they will yet take a leading position.

Then in order of merit we have the Plymouth Rocks, Brahmas, Scotch Greys, Black Orpingtons, and Langshans. These have certainly contributed in no small degree to build up the standard of our table poultry of to-day, but the first-mentioned varieties undoubtedly take the lead over all others.

I am aware that the great breast producer is the Indian Game, yet, strange to say, out of the tens of thousands of heads of poultry which pass through my hands yearly at the Export Depôt, not 1 per cent. have shown the slightest trace of this particular breed; but I must candidly admit that the poultry farmer has replaced this deficiency with the aid of the corn sack.

THE HISTORY AND PRESENT POSITION OF THE BEET-SUGAR INDUSTRY AT MAFFRA.

By F. J. Howell, Ph.D.

The history of the beet-sugar industry at Maffra is not one which at first sight is calculated to inspire either confidence or enthusiasm. Started in 1897, the first campaign of 1898 created disappointment, while the second of 1899 ended even more disastrously. A splendidly-equipped factory, with a capacity of 420 tons per day, had at its disposal for the first campaign 9,109 tons of roots grown on 1,287 acres; while in the second year the available supply had fallen to 6,271 tons, secured from 1,509 acres. The average yield in the first case was at the rate of 7·08 tons to the acre: in the second 4·15 tons. It is no wonder that on such yields the industry proved an unprofitable one, and the factory closed down.

The Position of the Government.

The company had "availed itself of the benefits of the Beet Sugar Works Act of 1896, which provided Government assistance to any company formed under certain conditions by way of a 4 per cent. loan to double the amount of the capital contributed by the shareholders."

The building and equipment of the factory and the carrying on of the two years' operations represent an expenditure of over £90,000. Of this amount the Government had provided £62,000, and the company the remainder. After foreclosing, the Government called upon Mr. Van de Velde, who had been closely associated with the movement, for a report on the situation. The interest of Mr. Van de Velde in the beet sugar industry is well known, and his suggestions appear to me to have been at all times of a practical and well-balanced nature. Deprecating precipitancy of action in the starting of the factory in the first place, he advocated, before launching into a big expenditure, a system of caution and gradual initiation of the farmer into the cultural methods absolutely necessary to the success of the industry. His suggestions, since the closing of the factory, have all been on the good common-sense lines of first diffusing a wider knowledge and arousing a greater interest in the industry among the men who are to make it a success if it is ever to become one.

Mr. Van de Velde's Proposals.

These were that the industry should be supported by a new advance of £18,500 conditional on not less than 1,800 acres of sugar beet being guaranteed from either the Maffra or other districts. As the season turned out, it was thought the average might have yielded 25,000 tons of roots, producing 2,299 tons of sugar without the Steffen process. It was, however, not possible to secure guarantees for more than 1,500 acres, including 560 by the company, and the

alternative recommendations of Mr. Van de Velde were carried out. These, among other things, were :—

1st. That the cultivation of sugar beet be kept up in the district, and arrangements made with a number of farmers to undertake, under the guidance of an expert, temporarily appointed, an area of 100 acres of sugar beet in plots of not less than 2 acres each, and that at harvest time the results be officially obtained.

2nd. That in the meantime the resource of the district be studied from the point of view of the possibility of obtaining a full beet supply within a certain radius from the factory, and that a scheme be devised for starting the factory afresh, and on a sound basis, should it be proved by this season's crop that sugar beet can be profitably grown in the district." The carrying out of these suggestions were sanctioned, and the supervision of the experimental work placed in the hands of Mr. Van de Velde.

The Results of Experiments.

At the conclusion of the season Mr. Van de Velde furnished a second report, dated 12th July, 1900. This embodied the results of the experiments carried out under his supervision, and offered suggestions for the continuation of the work. The average results of the 35 fields put down in the preceding year were, when compared with those of the two campaigns, of an exceedingly satisfactory nature, and are given below:—

Name of Growers.	Districts.	Date of First Test.	Date of Harvest.	Weight of Roots per Acre Tons of 1,000 Kilos.	Quotient of Purity.	Per Cent. of Sugar in Roots.
Martin, Thos.	Newry	February 8			86.0	14.8
"	"		March 14	21.750	85.7	15.5
McCamey Bros.	Boisdale	February 7			80.0	16.8
"			March 9	21.204	85.8	13.4
Caffrey, Hugh	"	February 13			82.6	13.8
"	"		March 9	19.760	83.7	13.7
Mortimer, M.	"	February 13			78.0	15.2
"	"		March 9	19.006	83.1	14.0
Glassford, C.	Maffra	February 7			83.6	16.7
"	"		March 7	17.336	80.0	14.9
Amey Bros. ..	"	February 21			84.3	15.8
"	"		March 6	16.314	85.7	15.4
Vance, James	"	February 6			83.1	16.0
"	"		March 6	16.580	81.2	14.8
Clyne, David	Newry	February 12			91.8	15.0
"	"		March 7	16.340	84.2	14.0
J. Boland and S. Dwyer } 4 acres	Maffra	February 28		...	82.7	16.6
"	"		March 7	13.733	83.0	14.8
Shaw, John ..	Newry	February 8			86.2	15.4
"	"		March 12	15.036	79.7	13.1
Linton, C.	Maffra	February 6			86.2	19.1
"	"		March 6	11.049	86.7	17.4
Gammon, J.	Tinamba	February 12			80.7	18.0
"	"		March 7	11.370	86.3	16.0
Carr, Thos.	Newry	February 8			79.7	15.9
"	"		March 14	15.726	80.5	12.0
"	Boisdale	February 7			88.2	15.9
"	"		March 9	16.580	80.3	11.1
Simpson, J.	Stratford				88.1	16.2
"	"		March 12	12.341	85.9	14.4
Blundy, R.	Briagolong	February 10			88.5	15.55
"	"		March 22	12.170	92.00	14.4
Geoghegan, P.	Maffra	February 6			86.7	15.3
"	"		March 6	11.241	84.8	15.2
A. Miller and F. Pollock {	Upper Maffra	February 22			85.6	15.0
	"	"	March 9	13.706	85.3	12.4

THE RESULTS OF EXPERIMENTS—*continued.*

Name of Growers.	Districts.	Date of First Test.	Date of Harvest.	Weight of Roots per Acre Tons of 1,000 *Kilos.*	Quotient of Purity.	Per Cent. of Sugar in Roots.
Turner, J.	Boisdale	February 7	..	..	88·6	18·2
"	"	..	March 7	10·671	84·2	15·0
Austin, T.	Bundalaguah	February 10	..	..	87·5	17·00
"	"	..	March 8	9·344	90·0	16·7
Shugg, J.	Sale	February 21	..	..	85·9	16·8
"	"	..	March 12	11·264	80·1	13·5
Carr, J.	Stratford	February 16	..	..	81·1	14·9
"	"	..	March 16	9·297	87·8	16·1
Emson, Prob.	Maffra	February 10	..	..	91·1	19·0
"	"	..	March 8	9·156	89·0	16·0
Hamilton, A.	Stratford	February 22	..	..	84·1	14·6
"	"	..	March 22	10·725	84·5	13·6
Wright, D.	Newry	February 6	..	..	89·7	16·0
"	"	..	March 13	9·448	85·9	15·4
Weir, D., junior	"	February 8	..	..	92·5	16·5
"	"	..	March 14	11·052	80·5	13·1
Schweeder, H.	Bundalaguah	February 21	..	..	85·2	15·4
"	"	..	March 19	9·745	88·2	14·4
Scott, J.	Maffra	February 28	..	..	88·6	18·8
"	"	..	March 6	5·315	88·7	16·2
Anderson, T.	Tinamba	February 12	..	..	86·8	16·2
"	"	..	March 13	9·496	84·2	14·0
Manson, W.	"	February 8	..	..	88·4	17·0
"	"	..	March 9	9·573	87·7	13·6
Ferguson, J.	Newry	..	..	..	91·9	15·5
"	"	..	March 9	7·585	91·3	15·6
Cross, G.	Bundalaguah	February 10	..	..	93·7	17·8
"	"	..	March 19	6·399	87·9	14·3
Rooney, J.	Maffra	February 28	..	..	82·4	14·3
"	"	..	March 19	5·575	88·5	15·5
Mills, J.	Stratford	February 20	..	..	83·1	16·9
"	"	..	March 16	5·251	85·3	15·00
Amey, J.	"	..	..	..	85·7	16·6
"	"	..	March 16	5·191	91·7	14·9
Kerr, S.	..	February 9	..	..	89·0	17·0
Boland, M.	..	February 13	..	..	79·7	16·6
Knox, J.	..	February 12	..	..	89·4	16·0
Weir, J., senior	..	February 8	..	..	92·5	16·5

The average yields amounted to 11·73 tons of roots per acre of 14·83 per cent. of sugar and 85 purity. It must not, however, be forgotten that these were the results of small fields and not of large areas. From the tone of Mr. Van de Velde's report, there appeared to be no doubt in his mind as to the possibility of growing remunerative crops in the Maffra district; but there was evident the fear that it would require time to educate farmers to the same belief. The confidence of the farmer in the possibility of establishing the industry had been shaken by failure, and according to the writer, although the success of the year's crop under review had removed that doubt to a certain extent, it had not done so sufficiently for recommencing operations at once. He, therefore, drew attention to the probability of a protective duty under federation, and stated that this was the only thing wanting to make the beet sugar industry a success. But as the framing of the Federal Tariff would not take place for some two years, and since till such time no one would think of investing capital in the industry, Mr. Van de Velde suggested that the work of this period should be of an educational nature, and that an interest should be aroused by lectures, field experiment and publications in the southern portions of Victoria, so

that when the Maffra factory was again started, and land in the immediate neighbourhood purchased, for settlement, there would be no difficulty in securing applicants.

Mr. Pearson takes over the Work.

The Agricultural Chemist was next called upon to report on the position of affairs by the Honorable Geo. Graham, and Mr. Van de Velde was relieved of his position. Mr. Pearson had already carried out a number of experiments in beet-growing in different parts of the State, and was a warm believer in the final success of the industry. The work of continuing the experiments was placed in his hands, and he commenced work with his characteristic energy and thoroughness. Although late in the season the names of 33 farmers were secured as willing to carry out ½-acre lots. The results in the following year were of a highly satisfactory nature. The following tables taken from Mr. Pearson's report give the yields on 29 fields :—

—	April.			
	Tons of Roots per Acre.	Per cent. Sugar in Roots.	Purity.	Tons of Sugar per Acre.
John Scott, Maffra	19·39	17·43	86·3	3·38
Thos. Martin, Newry	23·45	14·86	84·8	3·48
Thos. Carr, Newry	18·75	16·55	89·6	3·11
John Webster, Newry	17·68	15·10	84·2	2·67
Ruben Blundy, Briagolong	15·00	16·87	88·2	2·53
John Gannon, Tinamba	14·73	16·53	91·5	2·43
Samuel Kerr, Sale	16·48	14·63	83·2	2·41
James Shugg, Sale	15·99	15·10	83·8	2·41
Stephen Dwyer, Maffra	16·80	14·50	81·7	2·44
Thos. J. Anderson, Tinamba	14·87	15·45	84·0	2·30
McCamey Bros., Tinamba	13·71	14·95	88·4	2·05
Wm. Garden, Stratford	15·27	13·83	81·6	2·11
Arnold Linton, Maffra	12·73	16·70	88·7	2·13
John Mills, Stratford	13·83	14·10	79·9	1·95
Patrick Geoghegan, Maffra	14·38	15·90	85·9	2·29
Thos. Linton, Bundalagua	12·59	15·85	83·6	1·96
Hugh Caffrey, Boisdale	12·25	15·75	84·3	1·93
Malacchi Mortimer, Boisdale	9·45	16·85	86·2	1·59
Geo. Cross, Bundalagua	11·36	15·55	83·0	1·77
Jas. Carr, Stratford	8·31	17·10	91·7	1·42
Wm. Manson, Newry	10·15	16·10	84·1	1·63
Thos. Napper, Sale	7·67	17·30	91·7	1·33
Wm. Duggan, Briagolong	8·11	17·80	87·1	1·44
Henry Schroeder, Bundalagua ...	9·46	15·15	83·6	1·43
Jas. Turner, Boisdale	6·13	16·20	90·4	·99
Andrew Hamilton	10·91	11·80	78·0	1·29
Robt. Emson, Bundalagua	7·45	15·03	80·0	1·12
Jas. Simpson, Sale	8·91	13·30	81·3	1·18
Brown Bros., Sale	4·65	13·65	83·6	·63

A Continuation of the Plots.

The results of this year's operations seemed of such a promising kind that the Honorable John Morrissey sanctioned the continuance of the plots for another year, and in 1901 there were 32 farmers within

factory limits who expressed their readiness to grow and cultivate plots. The determination of the results of these tests will be the work of the next few months. The season has been a particularly trying one, but it is to be hoped that the returns of the present year will prove as satisfactory as those of the two preceding.

The Present Position.

We have traced, then, the fortunes and misfortunes of the industry down to the present moment, and the question now presents itself—What advance has been made since the factory closed down three years ago, and have the tests which have been conducted during that period presented facts which now enable us to say with any greater certainty that the re-starting of the industry at Maffra would result in greater success than before? To answer those questions we must find out what were the principal causes of failure, and discover if a wider experience has removed those causes.

The Question of Climate.

The industry, it is said, had the misfortune to start with two of the worst seasons on record, and the average yield for the two years was at the rate of 7·08 and 4·15 tons to the acre. It is not, then, unreasonable that the climate of Maffra should have been widely condemned as one toatlly unfitted for the successful growth of the beet plant, but individual results obtained even during these unfavorable periods indicated that the general failure of crops might be ascribed to causes other than climatic conditions. In the year of 1898 there were crops which could be classed as good, and if the general average of the district had reached such yields, there is reason to think that the factory might have been running to-day. As one instance:—In the first year's operations the yield of the 95 acres of the Directors' Syndicate might be compared with the 962 acres of 62 farmers. The first gave 9·364 kilos of clean beets to the acre; the second, 4·296; while a crop of 40 acres on the farm of Mr. Landry gave an average of over 13 tons to the acre. The land in the last case mentioned had been prepared in the autumn, and as the Directors in their report state, the results were highly suggestive. It is, then, no wild hazard to say that the low yield of the first two years were the result, not so much of unfavorable seasons, as of want of knowledge in cultural operations, unsuitable soil conditions, late preparations of the land, and neglect of the crop at critical periods.

Improvements in this Direction.

The purpose of the plots established during the last three years was to educate the farmer into adopting the methods required in successful beet-growing. That the object has in very many cases been attained, is shown by the splendid yields obtained in a number of cases; but that all have not learned the lesson is equally as evident by the small returns at the other end of the list. The fact has also been made clear that on good land, even in indifferent seasons, it is possible to produce

crops which, could such an average be reckoned upon, would render beet-growing a most profitable industry in the Maffra district. Like every other crop the beet will have its seasons good and bad, but there is nothing to suggest that there are greater risks in the growth of this crop than any other crop, while everything points to the possibility of it finally becoming one of the most profitable undertakings the farmer in a great portion of Victoria could engage in.

Other Considerations.

The possibility of successfully growing the crop in Maffra, as far as soil and climate are concerned, is then supported by facts resulting from the experience of the last five years; but there are other considerations which will decide whether beet-growing will ever become a profitable industry in this district. All, I think, must admit that the selection of Maffra as a site for the first attempt at sugar-growing in Victoria was a most unfortunate one, not owing to any special drawback as regards soil and climate, but because established in the very centre of a number of large estates, and in a community almost entirely devoted to grazing, and ignorant of agricultural operations. The Boisdale and Power's Court Estates stretch for miles to the north, east, and south, while to the west are the extensive properties of Glassford and Co., and Mr. O'Brien. It is only beyond these areas under present conditions that one could expect to find a class of men, and even those in limited numbers, likely to engage in the industry; but in their case there is the serious handicap of long haulage to a factory, with the attendant cost and waste of time.

It is true the Boisdale Estate has been recently cut up into holdings of about 160 acres, but as only 1-10th per cent. of this area is allowed to be brought under cultivation, the quantity of beet that would be now procurable from the property would be less, probably, than when the factory was running. The matter, then, of successfully restarting the industry at Maffra narrows itself down to two questions:—

1st. Would it be possible to purchase at reasonable rates a portion of suitable properties in the immediate neighbourhood of the factory for subdivision into beet farms?

2nd. Could a sufficient number of settlers of the proper sort be secured under guarantee to provide the greater portion of the crop considered necessary for a successful campaign? Both Mr. Van de Velde and Mr. Pearson have looked in this direction for a solution of the question of profitable beet-growing at Maffra. The first, in his report of 1900, says—"The company that will ultimately take up this matter will have to buy land in the district, and subdivide it for a close settlement of beet farmers." Mr. Pearson, in his report of 1901, writes—"The answer to the beet-sugar question in Victoria appears to me to be quite simple. Settle on the land around that Maffra factory 150 or 200 beet-growers. Men of the market garden type of cultivator, who will make beet-growing their primary business, and adapt all the rest of their farm economy to the requirements of the beet crop, and the beet-sugar industry in Victoria will be straigatway a success."

Can we procure Suitable Settlers?

That the land might be cheaply secured is, of course, possible, but the difficulty of suitable settlement is a greater one. This has already been foreseen, and suggestions made for overcoming it. There is little doubt the suggestion made in a report already referred to, to the Government, for offering inducements to farmers in Gippsland and the Western District, to grow small areas of beets, would, had they been carried out, have tended to make a number of men familiar with the cultural methods adopted in the growth of this crop, and perhaps provided, when the moment arrived, a number of suitable applicants for taking up lots at Maffra. Beet-growing is not learned in a day, and it takes some time to convince a farmer that the delay of a week only in carrying out a simple operation might mean the reduction by one half of the yield of his crop. Even to-day at Maffra, after six years from the first start, the number of farmers who have thoroughly gripped the full meaning of all the essentials in successful beet-growing appears to me a limited one. Autumn ploughing and the winter fallow are I fear the exception and not the rule. Thinning, it is told me, is almost invariably left till long after the time it ought to be carried out, while the only cultivation the general crops, I believe, receive are two hoeings one hand, followed by the horse, and yet with this small trouble we find crops averaging their 15 and 17 tons. With greater attention 20 and sometimes over are secured, while the almost entirely neglected crops decline to yields of 5 and 6 tons and sometimes lower. Splendid as the yields, in certain cases, have been, they have, to my thinking, by no means reached the possible maximum under more perfect systems of growing. We must remember then that a body of men taking to a new industry will not show to the best in a first year's effort. It will take some time to educate the general beet-growers, even to the imperfect standard at present reached by the better growers of the district. Capital engaged in this industry must recognise this. The results of the progress of the industry at Chino and Utah are a valuable lesson of the improvements which might be expected to take place from year to year, both in yield and quality, as the farmer becomes more accustomed to his work.

		1891	1892	1893	1894	1895
Chino	Acres of beets grown ...	1,800	3,488	4,191	4,778	7,528
	Tons of beets produced ...	13·080	26·266	49·353	43·773	83·035
	Aver. yield per acre, tons...	7·26	7·50	11·7	9·16	11·03
Utah	Acres of beets grown ...	1.500	1,500	2,755	2,850	3,300
	Tons of beets produced ...	9,960	9,816	2,680	32,694	38,108
	Aver. yield per acre, tons...	6·6	6·5	9·7	11·47	11·54

In the first campaign of each of these factories, neither in acreage under crop, nor yield per acre, was there much difference from those of the first year at Maffra. In the second year also the crop could by no means be considered a profitable one, but three years later there were treated at Chino no less than 83·835 tons of roots, with an average yield of 11·30

tons per acre ; while at Utah the crop for 1895 rose from 9,960 tons in 1891, the yield practically of the first year at Maffra, to 38·108 tons, *showing an average yield per acre nearly double what it was in the* first campaign.

The Minimum Yield in Profitable Beet-growing.

Before capital can be expected to take up the industry again, and I suppose we must look to outside capital and not the Government to undertake this, there must be clear evidence that it can be done so at a profit. There is some little difficulty in the early stages of the industry in arriving at anything like an accurate statement of the cost of production, and hence, at the minimum yield at which beet growing might be considered a profitable undertaking. The average yields of several large American concerns where beet growing is recognised as a *profitable industry is therefore of interest. The following tables are* taken from Dr. Wiley's last Report (1899):—

Statistics of Individual Factories for the Year 1897.

Name of Factory and Location.	Beets harvested.	Beets harvested.	Price paid per Ton of Beets.	Time the Machinery was in Operation.	Sugar Content of the Beets.	*Total Output of Granulated Sugar.*
	Acres.	Tons.		Days.	Per ct.	Pounds.
Alameda Sugar Co., Alvarado, Cal.	4,808	48,773	4·00	90	14·20	10,198,648
Chino Valley Beet Sugar Co., Chino, Cal.	9,678	97,197	...	151	15·10	24,303,122
First New York Beet Sugar Co., Rome, N.Y.	700	4,325	5·00	45		765,700
Oxnard Beet Sugar Co., Grand Island, Nebr.	4,282	38,607		...	12·90	6,798,300
Los Alamitos Sugar Co., Los Alamites, Cal.	2,800	29,542	4·16	105	15·73	6,017,900
Norfolk Beet Sugar Co., Norfolk, Nebr.	4,029	36,113	...	...	13·60	7,941,400
Pecos Valley Beet Sugar Co., Eddy, N. Mex.	1,600	5,700	4·00	38	14·00	1,020,000
Utah Beet Sugar Co., Lehi, Utah	3,000	18,500	4·25	56	13·20	3,670,600
Western Beet Sugar Co., Watsonville, Cal.	10,375	110,878	4·00	104	15·00	29,776,000
Total	41,272	389,635	..	...	...	90,491,670

The general average works out at 9·44 tons per acre of a sugar per cent., excluding the New York Company, of 14·21. It ought, however, to be stated that this season was not a favorable one to the production of beets in several of the localities named. Comparing

these returns with the average yields of the last two years on the plots at Maffra it will be seen that the latter are heavier by a good deal.

		Tons roots per acre.	Sugar per cent.	Purity.
	Average of 35 crops.			
Mr. Van de Velde's yields, March, 1900.	2 acres each	11·7	14·8	85·0
	Average of 29 crops.			
Mr. Pearson's yields, April, 1901.	½ acre each	12·79	15·50	85·2

In Mr. Van de Velde's experiments the maximum crop was 21·4 tons, and the minimum 5·1 tons per acre. In Mr. Pearson's experiments the maximum reached 23·45 tons, and the minimum 4·65. There were eleven of the growers obtained over 15 tons per acre with Mr. Van de Velde, and nine with Mr. Pearson. There was, it appears to me, really no valid reason why a single grower should, where eleven others had exceeded the yield of 15 tons per acre, fall below that figure. If it is tried to explain this by the variations in soil, the answer is ready to hand; for there are thousands of acres within easy distance of the factory as good and as suitable in every way for beet-growing, as any of the eleven farms which produced the larger yields, and if beet growing is to be again taken up it is such soils which will have to be selected. The truth is, when the matter is inquired into, that the differences in soils have had in most cases nothing to do with the matter, but the cause has been in faulty methods of cultivation and neglect of the crop at critical periods. From results already obtained, then, one feels justified in thinking that under proper methods of cultivation on suitable soils, and in any but an exceptional season, there is no reason why the general average of the district should not closely approach, and perhaps reach, 15 tons per acre. With such yields beet growing in Maffra ought to be considered a profitable undertaking.

This might be made clear by the consideration of a few estimates of the cost of producing and harvesting an acre of beets.

Estimates from Different Sources.

It will be seen, from the estimates from various sources given below, that there are great differences of opinion as to the cost per acre of producing a fair average crop of beetroots. Mr. Van de Velde's estimate, appearing in his first report, is as follows:—

	£	s.	d.
Rent of land	£1	5	0
Deep ploughing, 12 inches	0	10	0
Harrowing	0	2	0
Second ploughing, 6 inches	0	5	0
Two harrowings and one rolling	0	6	0
Disc harrowing	0	2	0
Harrowing	0	2	0
Sowing (including rent of drill)	0	2	0
Seed, 20 lbs. at 8d.	0	13	4
Thinning	1	0	0
Two scarifyings	0	6	0
Hand weeding	0	2	0
Harvesting	0	7	0
Topping, 13 tons at 2s. 6d.	1	12	6
Cartage, 13 tons at 2s.	1	6	0
Total	£8	0	10

Mr. Pearson's estimate, which has been considered too low, is, leaving out the cost of manure, in very close agreement with that of Mr. Van de Velde's:—

Ploughing and preparing seed bed	£1 5 10½
Thinning and hoeing	2 1 10½
Harvesting and topping	1 12 0
Carting	1 17 6
Seed	0 8 0
Manure	2 8 0
Interest on farm	1 5 0
	£10 18 0

It was found out afterwards by Mr. Pearson that the manurial dressing was in excess of the requirements of the soil, and could be reduced by £1 13s., making the cost £9 5s. 3d. per acre.

The itemized cost of the production and harvesting of an acre of beets by Dr. Wiley, appearing in the *Year-book* of 1892, is made up as follows:—

1891.			
October	1	... Light ploughing	$1·68
,,	25	... Deep ploughing of ground	2·00
		Subsoiling of ground	2·00
1892.			
April	28	... Disc harrowing of ground	0·38
,,	29	... Twice harrowing, at 17 cents	0·34
,,	,,	... Rolling	0·17
,,	,,	... Cost of seed (17 lbs., at 15 cents)	2·55
,,	,,	... Drilling seed	0·52
,,	,,	... Rolling after drill	0·17
June	2	... Horse-shoeing	0·62
,,	8–10	... Thinning out (65 hours at 12½ cents per hour)	8·12
,,	17	... Hoeing by hand (50 hours, at 12½ cents) ...	6·25
,,	21	... Horse-shoeing	0·62
,,	27	... Horse-shoeing	0·62
July	7	... Soiling up beets	3·62
Total cost of production			$30·28
Harvesting by hand			13·50
Transporting 12½ tons beets 3 miles at 5 cents per ton ...			6·00
Rent of land at $2·50 per acre			2·50
Total cost of planting, cultivating, and delivering to factory ...			52·58

This is a very heavy expenditure, and one that might frighten the intending beet-grower; but as Dr. Wiley says—"*The result must be* interpreted in the light of the fact that it is not possible to produce a single acre of any crop with as much economy as a larger area could be produced proportionally . . . . the cost of harvesting as given in the itemized account is fully double what it would be in ordinary beet culture." In the above figures is given the total expense of a single measured acre of beets as the account was paid for at the station. Dr. Wiley rightly says—"There is, of course, no doubt of the fact that in field culture, where such great care is not exercised, the cost may be materially diminished."

Farmers' Estimates at Maffra.

It appeared to me of value to secure from some of the more experienced growers at Maffra, their opinions on the subject, and Mr. Lee,

the Agricultural Superintendent, secured at my request the following statements:—

The Estimate of Mr. T. Martin, of Newry.

	£	s.	d.	
Rent	£1	0	0	per acre
Ploughing	0	10	0	,,
Harrowing twice at 6d.	0	1	0	,,
Rolling twice at 6d.	0	1	0	,,
Planting	0	2	0	,,
Seed, 15 lbs., at 8d.	0	10	0	,,
Thinning	1	10	0	,,
Hoeing twice at 7s. 6d.	0	15	0	,,
Ploughing out	0	5	0	,,
Topping 12 tons at 4s.	2	8	0	,,
Carting, 1s. per ton per mile, 5 miles Tinamba, R. S.	3	0	0	,,
	£10	2	0	

Estimate of Mr. Carr.

	£	s.	d.	
Rent	£1	0	0	per acre
Ploughing twice	0	15	0	,,
Harrowing at 9d.	0	1	6	,,
Rolling at 9d.	0	1	6	,,
Planting	0	2	0	,,
Seed	0	10	0	,,
Thinning	1	10	0	,,*
Hoeing twice	0	10	0	,,
Topping, 12 tons at 5s.	3	0	0	,,
Carting, 12 tons to Maffra, 6 miles, 1s. per mile...	3	12	0	,,
	£11	2	0	

Estimate of Mr. Webster.

	£	s.	d.	
Rent	£1	10	0	per acre
Ploughing	0	10	0	,,
Harrowing twice } Rolling twice }	0	3	6	,,
Planting	0	2	0	,,
Seed	0	10	0	,,
Thinning	1	5	0	,,
Hoeing twice at 6s.	0	12	0	,,
Ploughing	0	5	0	,,
Topping, 12 tons at 3s. 6d.	2	2	0	,,
Carting, 12 tons at 3s. 9d.	2	5	0	,,
	£9	4	6	

The Estimates too High.

Most of the items in these three estimates are high compared with those available from the statistics of the various sugar companies, as well as of individual growers, in different parts of America. This is especially so in the case of *thinning and topping*; where evidently a wider experience on the part of the American workman has enabled him to work much more economically. A number of valuable statistics is given in the work of Herbert Myrick, already referred to. The Utah Sugar Company, to take one instance, gives the expense of ploughing out the beet at one dollar per acre.

Pulling and topping beets at only 50 cents per ton, or in a crop of 12 tons at 6 dollars per acre, and thinning at 5 dollars per acre. It will be also observed that the item of haulage is a very heavy one in the case of the Maffra growers, and in the case of subdivision and settlement of the land within easy distance of the factory; this item might be reduced by half or more. Nothing so prominently brings out the unsuitability of the site of the factory under present conditions as this cost of cartage. The place of a factory is in the beet-fields, and not miles removed from them.

A Profit even at this Cost.

It will prove of interest and value to turn to the yields obtained by the three Maffra growers who have furnished these figures of the cost of production and harvesting, for if it were possible generally to obtain anything like the results obtained by these three growers on small areas, beet-growing in the district even under the heavy cost of production referred to would still prove a profitable industry.

Results obtained on Small Areas by Messrs. Carr, Martin, and Webster.

—	Year 1900.		Year 1901.		Value per ton Factory prices.
	Mr. Van de Velde's Experiments.	Per cent. of sugar.	Mr. Pearson's Experiments.	Per cent. of sugar.	
	Tons cwt. qrs. lbs.		Tons.		
Thomas Carr ...	15 19 1 2	12	18·78	16·55	£17 12s. 1½d.
Thomas Martin ...	21 7 2 27	15·5	23·45	14·86	18 9s. 4d.
John Webster ...	...	..	17·68	15·10	14 11s. 8½d.

It will be seen that in Mr. Carr's case, in the season of 1901, there was a profit of £6 7s. 1½d. per acre; in Mr. Martin's, £8 7s. 4d., and in Mr. Webster's, £5 7s. 2½d. But I would again draw attention to the fact that these results were not obtained from large areas, although, in my opinion, there is nothing to prevent an average yield of 15 tons, or something approaching it throughout the district.

The Greater Profits of Dairying.

It seems everywhere the tacit assumption that land-owners in the district are doing so well out of dairying and grazing that it will require some very great inducement to tempt them again from a payable certainty into what two years ago proved an unprofitable venture. There seems a tendency to draw unfair comparisons between the costs and profits of the two industries. In setting out the cost of producing a crop of beet-roots the labour required is always looked at from the stand-point of an actual loss on the part of the farmer, through the payment that would have to be made if outside labour were actually employed for the work. The farmer seems in this case to forget that 60 to 75 per cent. of the cost of beet production can be set down to

labour which ought to be, and probably would be, carried out by himself and family at remunerative wages. In the case of dairying the like remuneration for the long hours that would, did he not carry out the work himself, have to go into another pocket, besides other important matters seems to escape consideration, and the receipts at the factory are looked upon in the light of almost pure profit. There is naturally some difficulty in getting at the profits resulting from dairying in the Maffra district, but these I feel confident are not so high as to preclude, if the matter is looked at without prejudice, the greater possible profits of beet-growing receiving the recognition it ought to. The remarks of Mr. Lee, who was requested by me to obtain information on this point, are worth giving. Mr. Lee writes—"They (the farmers) all admitted that if dairying was charged with each item of expenses, such as rent of land, labour of men, and many other charges, it would not be considered one-half so profitable. In every case where I have visited I am informed that the dairying is paying very well, although no one could tell me what the profit per acre per annum was. The side profit of skim milk, it seems, is the chief point in its favour on account of calf and pig raising." It is when combined with beet-growing that dairying will appear in an even better light.

Can the Factory be re-opened?

It is, in my opinion, useless to attempt negotiations for re-starting the factory until the agricultural question has been settled. The problem to be first solved is the agricultural one. To commence factory work before this problem has been solved would, I fear, be again to court disaster and delay the growth of the industry for some years to come. Whether undertaken by the Government or a company that might finally take over the factory land in the immediate neighbourhood of the factory must be secured and free for settlement with farmers under guarantee to provide the greater portion of the roots required for a successful campaign. The men who might be called good farmers in the Maffra district are few, and are for the most part settled at distances which for the present, at any rate, may be considered beyond profitable limits. Where thoroughly good crops can be relied upon year after year, it is quite possible that beet-growing might be highly profitable at great distances from the factory, but the secret of profitable beet-growing is to have the crops as closely centred round the factory as possible, especially in the early stages of the industry. If land is secured and taken up it must be recognised that autumn ploughing and the winter fallow are necessary. To trust to spring cultivation of grass lands for a beet crop could only end in disappointment to the growers.

The Industry in general.

In treating of this, one stands on firmer ground, and can speak with greater confidence. The tests already made in different parts of the State offer, I think, sufficient evidence to show that over a large area of Victoria beet-growing might become one of our greatest industries. It is time that the matter should be given the greatest prominence

possible, and by a vigorous lecturing campaign of a few years, in conjunction with experimental beet plots distributed as widely in the southern portions of our State as the manure test fields were in our northern areas. I feel sure that there would be the same great interest aroused, and the like valuable information follow in the matter of beet-growing as there has in manuring. There are 16 tons of seed already a little old, to be looked on with favour, lying in the basement of the factory at Maffra. This, sent to every Agricultural Society in all portions of the colony considered suitable to the growth of the crop for distribution among the farmers, might lead to something, but to test the matter as it should be would require taking up just as the manure question was taken up. It would mean much work both in the field and laboratory, and provision for such would have to be made, not in the disheartening manner with which funds for all similar work seems to be granted at present, but in such a way as to allow such work being carried out properly. In some three or four years from the first attempt there ought to be the foundations laid for the success of an industry that will do as much for Victoria as it has done and will do for the United States of America.

FORAGE PLANTS.

Lucerne, or Purple Medick, *England.* (Luzerne, *France and Germany.* Alfalfa, *Spain and America*).

By H. W. Potts.

The past butter season, with its shortage, has again brought into full view one of the chief weaknesses of our dairying system—the failure to provide suitable forage crops to augment the natural pasturage for our dairy cattle.

The relative usefulness of forage plants is mainly determined by their nutritive constituents, and these are controlled by local conditions, climate, soil, situation, &c. They vary so widely in this State as to render it an almost impossible task to prescribe the specific fodders suitable for each district. It is, however, intended in a series of articles to direct the attention of our dairy farmers to a number of plants from which a selection can be made to provide the best and most economical food for maintaining and prolonging the milk flow.

The cost of production and the absolute returns necessarily form the feature of practical inquiry. The aim is to grow a crop giving *the largest amount of palatable and digestible dry matter.* The scarce months in our dairy season are those of late summer and early spring, and the climatic conditions prevailing have to be considered as well as the soil characteristics.

Amongst the foremost of profitable plants and crops are lucerne, maize, mangolds, and beet-root. It has to be recognised that these crops demand rich land, limited probably in area and of high value; but given such, no matter how small in area, these crops never fail to repay the cost of cultivation. Their initiative value as milk foods has been fully set out by the chemist.

The following table quoted by Jordan gives at a glance the comparative values:—

...	Yield per acre, Fresh Material.	Dry Matter.	Dry Matter per acre.	*Digestible* Dry Matter.	*Digestible* Dry Matter per acre.
	lbs.	%	lbs.	%	lbs.
Lucerne	35,000	25	8,700	69	5,162
Maize, whole plant	30,000	25	7,500	61	5,025
Red clover (about 3½ tons new hay)	18,000	30	5,400	57	3,070
Oats and peas	20,000	16·2	3,240	65	2,160
Timothy (about 2¾ tons new hay)	11,500	38·4	4,416	57	2,517
Hungarian grass	19,000	25	4,750	67	3,182
Mangolds	60,000	10	6,000	88	5,200
Sugar beets	32,000	20	6,400	88	5,632
Potatoes	18,000	25	4,500	85	3,825

Here it is noticed that fodder crops are much unlike in composition. The maize and lucerne stand out prominently as nutritive foods in comparison with grasses, oats, and peas.

From a dairyman's stand-point he may easily select the species of forage plants as being the most profitable—lucerne and maize. Their value is simply undebatable.

The subject of this paper—lucerne—may be regarded as the "prince of fodders."

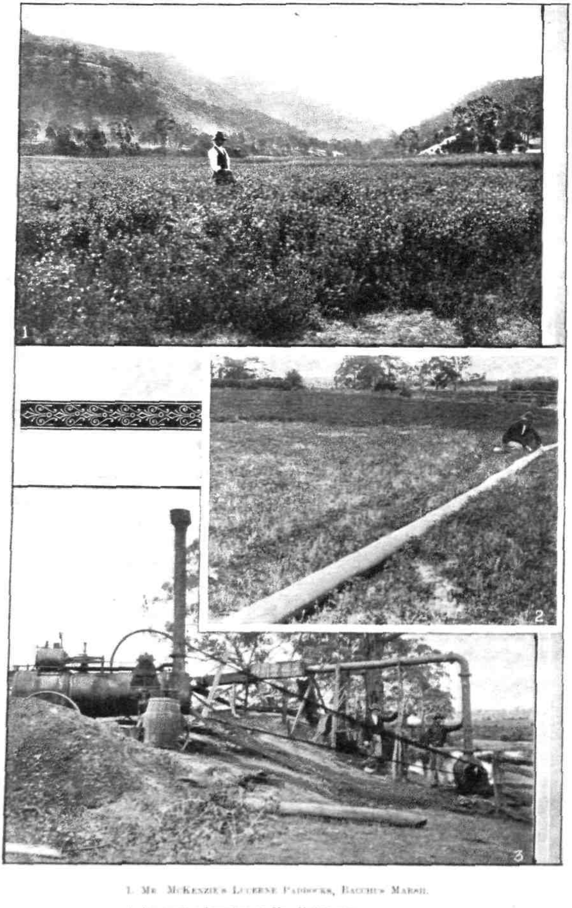
Where the soil is rich, limy, open, and naturally well drained, lucerne provides the heaviest and richest of nitrogenous fodders known. It thrives to an astonishing degree, when given sufficient moisture, in our bright sunny climate, and possesses a deep root system. The plant is perennial in habit, *i.e.*, will live and grow for more than two years. In some districts in the State, particularly Bacchus Marsh, its term of root-life has not yet been determined. Mr. McFarlane points to his paddocks in full growth now as a proof of this. They were sown down in 1872, and show no sign of giving out. It is a gross feeder, and its roots on the banks of the Werribee and Lerderderg Creek have been traced to a depth of 15 feet. The fodder is noted for its richness in protein, a substance which provides the requisite chemical elements, largely recruited from the atmosphere, to stimulate the growth of bone, muscle, tendon, solids in milk, skin, &c.

This fodder is equally relished alike by cow, horse, or sheep, and with horses they are known to perform hard work on this food alone. It is a native of Eastern Europe, and is now being brought into prominence as a fodder in England, Canada, Australia, United States, and Argentina. In the San Joaquin Valley in California a single block of land 30,000 acres in area, and owned by a company, is covered with lucerne, and is so situated as to be irrigable during the hot months of the year. It provides five to seven cuttings during the year of from 1 to 2 tons each. Lucerne is a strong feeder, and will penetrate the soil to wonderful depths to reach moisture. At Wisconsin it was found to go through a close soil, with clay subsoil, to 4 feet in 174 days.

At Bacchus Marsh, which is the oldest district in Victoria where lucerne has been tested over 40 years ago, we find ideal conditions prevail for the growth of this excellent fodder plant along the banks of the Werribee and its tributaries, as well as in the Marsh. Here water is available, and either by direct irrigation from water conveyed by races from the higher levels, or by pumping machinery, the land is well soaked once a year. Where a pumping plant is employed it is generally estimated to cost about 25s. per acre.

The land is first prepared by being well cultivated in April, and being rich river flats of light friable loam, there is no need for more than one ploughing with light harrowing to render the surface fine.

Seed is sown broad-cast, about 20 lbs. to the acre after the first rainfall. At that period of the year rain is abundant, and provides the requisite stimulus to germinate the seed. Disappointment often awaits the uninitiated who look for immediate growth. It often takes three years for a paddock sown down in lucerne to get the roots thoroughly established and a free growth secured. The first and second year's crops are light in numerous instances.



1. Mr. McKenzie's Lucerne Paddocks, Bacchus Marsh.
2. Irrigating Lucerne at Mr. McArthur's.
3. Pumping Plant for Irrigating Lucerne.

As in other crops, a knowledge and experience, that can only be gained by constant observation and practice, is required to decide when lucerne needs water, and how to apply it, so that growth may be vigorously maintained. Further, this knowledge is essential to insure that no injury from drought may follow, or by too liberal use or application of water. Such determinations are guided by local experience.

Plants invariably indicate by a change in colour, whether they need moisture or have had too much. A crisp or dead appearance in the lower leaves is, as a rule, the first sign of drought, and eventually they assume the condition of cured hay. On the other hand, if too much water is permitted to reach the roots, the plants acquire an unhealthy appearance and become yellowish-green in colour.

In Bacchus Marsh the rule is to water freely in January or February, whereas in other districts, such as the Goulburn Valley, it is not uncommon to irrigate lucerne paddocks twice and often three times a year.

In all places where there is an overflow or a waste of moisture, such as along the fringe of a dam or the banks of channels, lucerne grows luxuriantly in warm weather.

The crop, when cut for hay, is taken off before the plant has reached its full bloom. A good yield will weigh 1½ to 2 tons, and with six cuttings a total of about 10 tons for the year.

It is not considered good practice to graze horses or cattle on lucerne, as the hoofs of the animals bruise and injure the crowns of the plants. It is always considered best to mow the crop.

When feeding green, care should be exercised not to feed it fresh. Most of the dairy farmers cut enough every morning to last for one day's rations. This remains in the sun to "wilt" for the day, and is gathered in the evening and given to the cows next morning. It is then a sound rich sweet palatable fodder. There is then no danger of creating hoven or tainting the milk. An acre of well-grown lucerne will provide enough food for three cows. In many places we notice sheep being grazed on lucerne after a cutting. This, if practised continually, may end in the plant being permanently injured. When the young shoots start away from the closely eaten off stem, and are also eaten, then the vitality of the root is lessened, and may end in total destruction. The character, depth, warmth, and moisture of the soil are the determining factors to produce a good crop. A warm climate with light rainfall suits it best, and this is evidenced in such a dry place as Mildura; warm and dry overhead, but with moisture added by means of irrigation, the crops of lucerne grown there are simply phenomenal, showing that it grows most freely under a system of irrigation. Similar experience may be quoted in the Wimmera. Great care should be taken to select a soil that is easily drained; water if left on the plot more than 48 hours at a time has a tendency to injure the roots. Of soil constituents lime seems to be the most useful, but others, such as potash, magnesium, and phosphoric acid, act as necessary fertilizers. The accompanying photographs illustrate the crop and irrigation schemes pursued at Bacchus Marsh.

VEGETABLE PATHOLOGIST'S BRANCH.

DISEASES OF PLANTS AND THEIR REMEDIES.

By D. McAlpine.

An illustrated handbook is in the press dealing with the various diseases of stone-fruit trees caused by fungi, and two of the most important are here described, together with the best known methods of treatment. These are leaf-curl of the peach, and shot-hole and scab, particularly of the apricot.

I.—Peach Leaf-Curl.

(*Exoascus deformans.*)

The name of "curl" or "blister" has been given to this disease from the appearance of the affected leaves. The first formed leaves become thickened and puckered and discoloured, and soon fall away; then another set of leaves are produced, but too late to fully mature the fruit. The disease may be detected as soon as the leaf-buds have slightly opened, by the puckering of the surface and the bright colouration of the young leaves. As the leaves approach maturity the distortion becomes more marked, so that often the entire blade becomes corrugated and curled. The colour, too, is heightened, and the diseased parts have usually a bright ruddy appearance, often tinged with green, but every trace of green may ultimately disappear. Then the surface becomes a dirty grey, as if covered with flour, showing that the final stage of the fungus has been reached, and that the fructification is being formed, spores being produced to disseminate the disease. When the vitality of the leaf is exhausted it dries up and falls away, carrying a load of spores on its surface.

The distribution of the fungus is widespread, its presence having been reported from nearly every part where the peach is cultivated, and it has been known in Victoria since 1856. It occurs on the leaves and young shoots of the peach and nectarine in Australia, and all the symptoms of it, without the production of spores, have been found on the fruit of the nectarine.

Accompanying this disease, as well as others of the peach, there is often copious gumming.

Conditions favouring the Disease.

This disease, like so many others, is dependent on climatic conditions for its spread, and these conditions are often regarded as the cause, so that we hear of it being due to chilling at the roots, deficient root-action, and so on. It is said that a cool moist spring favours the disease, and it is well known that a sudden rise of temperature or drying winds check it at once, but such conditions affect the development of the fungus as well as that of the leaves.

The mistake is often made of confounding the accompanying climatic conditions with the determining cause of the disease, and then, of course, preventive treatment is out of the question, since we cannot control the weather. It is not too much to say that enormous annual losses occur through attributing many of the maladies of plants to imaginary causes, and it is only when proper scientific investigation is made that empirical remedies will give place to intelligent treatment. At a conference of Australasian fruit-growers, held at Wellington in 1896, one of the delegates said:—"One gentleman had recommended spraying for peach curl. He had found, from 30 years' experience, that spraying for peach curl was worthless. It was the difference in the temperature above and the temperature under the soil—which was so unequal—which caused some stagnation in the sap, and that caused the curl." And yet, when the true nature of the disease is understood, and its fungus origin recognised, so far from spraying being worthless, it is found to be a certain preventive, when done properly and at the right time.

The serious error so often made to-day by many self-styled "practical" men lies in holding to theories of disease which have long ago been exploded, and so we hear them talk with the utmost confidence of "fermentation of the sap," "overheating of the sap," stagnation in the sap," and so on, as if that accounted for every ailment, and was the sum and substance of vegetable pathology.

Nature of Fungus causing Disease.

While certain conditions predispose to the disease, there is always a distinct fungus associated with it. The disease, in fact, is caused by *Exoascus deformans*, the first or generic name indicating that the asci or bags containing the spores are produced naked, and not enclosed in a case, while the second or specific name expresses the deformity caused *by the fungus. The mycelium or filaments of the fungus ramify among* the cells of the leaf, absorbing the nourishment stored up there, and the plant endeavours to meet the increased demand made upon its resources by multiplying the cells, and causing an overgrowth of the tissues, hence the blistering, distortion, and thickening of the leaf.

About the end of November the spores are formed in the bags exposed on the surface of the leaf, and are readily scattered by the wind, being set free when mature.

Since the second crop of leaves are not usually infected, it would seem that the spores do not germinate immediately, but that they winter somewhere on the tree, leaf, or ground, and when the warm days of spring cause the buds to open, then they, too, burst into life and infect the young and tender foliage. Two modes of infection, however, are said to exist:—1st by means of spores, as already stated, and 2nd by means of a perennial mycelium which is said to pass the winter in the youngest portions of the one-year-old branches. But it has been definitely proved that the perennial mycelium is not responsible for more than a very small percentage of the infections in the spring, for experiments have demonstrated that by a single thorough application

of a suitable spray as high as 98 per cent. of infections may be prevented. The spray is efficacious, because most of the infections are due to spores which probably remain hidden in the leaf-buds over the winter.

Effects and Losses from Disease.

This is a disease which is very destructive, and rapidly spreads, principally by means of the spores produced on the surface of the leaves. In a bad season, a tree may be completely divested of its leaves, and although a second crop may appear later on, unaffected by disease, still they cannot make up for the previous loss. The season's crop is often practically a failure, and the wood for next year is imperfectly matured. While the tree survives the loss of its leaves, still many shoots die, and the vitality of the whole is weakened. It is no uncommon experience in some districts to lose practically the whole crop on such varieties as Early Rivers, which, besides being very susceptible, ripen their fruit so early that the tree has no time to recuperate.

This disease is cumulative in its effects, and, continued year after year without check, it gradually undermines the constitution of the tree, and causes its premature decay and death. It is difficult to estimate the annual loss caused, and it is greater than growers think, because a great deal of the mischief really due to it is attributed to other causes. In the United States it has been estimated, from reliable data, that the entire annual loss is not less than £600,000.

Treatment.

As early as 1896, the Department of Agriculture, Victoria, issued a "*Guide to Growers, No. 27,*" in which drawings and a description of the disease are given, together with the necessary treatment. That treatment consists in spraying with Bordeaux Mixture, for although a number of substances have been tried with more or less success, that is the cheapest, most easily applied, and most satisfactory in its results.

While spraying gives immunity from the disease, it is understood that all reasonable precautions are taken to check and curtail its spread. Thus, the fallen and diseased leaves are carriers of infection, and if it be impracticable to rake together and burn them, they certainly should not be gathered around the butts of the trees to form a mulch.

The following measures are recommended :—

1. Diseased branches should be cut back in the pruning season beyond the point of origin of the diseased leaves, and burnt. The object of thus pruning back is to get rid of the perennial mycelium in the affected branches, for although such swollen branches containing the mycelium are only supposed to be responsible for 2 to 3 per cent. of the injury, still they weaken the tree, and are better out of the way. But it is well known that the disease will not be prevented by merely cutting back the branches, nor is it practicable to remove the diseased leaves early, before the spores are produced, so that it is necessary to spray to destroy the spores of the fungus.

2. Spray with Bordeaux Mixture just before the blossom-buds open. The mixture at the rate of 1 lb. bluestone, 1 lb. quicklime, freshly slaked, and 8 gallons of water will be found most suitable, although from 7 to 10 gallons of water have been used successfully.

In wet districts, or situations specially liable to the disease, it will be found advisable to spray twice in the winter, first about the end of July, next about a week before blossoming. Spraying after the leaves are out is of little or no value.

In the United States Professor Taft has used successfully a spray consisting of 1 lb. bluestone in 25 gallons of water, applied from four to six weeks before the buds open; and in South Australia Mr. Robin has used, as early as 1891, a solution of bluestone at the rate of 1 lb. in 16 gallons of water.

II.—"Shot-hole" and "Scab."

There is a very familiar appearance in the leaves of many of our stone-fruit trees, where they are more or less punctured with roundish holes, as if riddled with shot, hence the name of "shot-hole" applied to the injury.

At first there are small diseased brown spots, often with a ruddy margin, and soon the pieces fall away, leaving the border quite firm and distinctly marked off from the surrounding tissue, due to the formation of a separation layer by the living leaf in order to heal the wound. The cause of this decay of the tissue in definite spots is due to various agencies, but generally to fungi, and although it is commonly attributed to a single fungus in Australia, determined by Dr. Cooke, viz., *Phyllosticta circumscissa*, yet, in reality, many different fungi are capable of producing the same effect.

This detachment of minute portions of the leaf, carrying the fungus with it, is a very convenient means of spreading the fungus. Instead of the leaf, as a whole, acting as a host, it detaches a number of minute dead portions, each of which may become a centre of infection.

The proper development of the spores, too, may depend upon their germinating in dead material, such as the excised portions of the leaf afford, for it has been shown in the case of the lily disease, due to a grey mould (*Botrytis*) that the fungus is unable to attack the living organs until it has thus germinated. And if the weather be damp at the period of germination, and the growing portions of the plant consequently tender and susceptible, then the spores will have the best possible chance of infecting the living tissue. Their small size, their immense numbers, and the readiness with which they are wafted by the slightest breath of wind, account for their rapid spread, and they are often so completely scattered as not to leave a single leaf on a tree unaffected.

Not only is the leaf affected in this way, but the self-same fungus may cause a "scab" of the fruit and a "brown spot" of the branches, just as many other well-known leaf fungi may extend their ravages to other portions of the plant. Thus the peach-leaf rust, which is generally associated with the leaf, as the common name denotes, may also attack the branches, and has been found causing disease in the fruit.

The investigation of the fungi associated with "shot-hole" and "scab" in various parts of Australia has shown that different species are concerned in it, but for all practical purposes they may be treated alike. As far as Victoria is concerned, the principal fungi have been determined which are associated with it, and a knowledge of their life-history, which is of great assistance in devising preventive measures, has been ascertained.

There are about ten fungi known in Australia to cause "shot-hole," but if attention be given to the two most common, and treatment applied at the proper season, the grower will have nothing to fear from this troublesome disease.

Fungi causing Disease.

The most common of all the "shot-hole" fungi belongs to the moulds*, and has been found on all the stone-fruit trees grown here, with the exception of the cherry. It has not been met with as yet in the fruit-growing districts north of the Dividing Range, but in the coastal districts it is very prevalent.

It not only produces its fructification on still living tissue, but also on tissue that has been dead for some time. On a peach twig which had been dead for over six months, the tufts of the fungus were found producing fresh spores, thus showing the necessity for removing and burning all dead wood as well as other diseased portions.

The mode of infection, too, has been clearly observed. Around the buds and among the bud-scales there are innumerable spores, some of them actually germinating and others ready to germinate. The young leaves are at once attacked, and the shot-hole effects quickly produced.

The other form is one of the capsular fungi,† producing its spores inside a case. It has been found on the various stone-fruit trees grown in Australia, and occurs on the shoots and fruits as well as on the leaves.

Rotten and shrivelled fruits picked up from the ground in winter were found to be profusely covered with the minute spore-cases, filled with innumerable spores, and such fruits undoubtedly serve to tide the fungus over to next season. On a small portion of a leaf, too, about one-tenth of an inch in diameter, I counted 30 spore-cases, and when it is remembered that each of these contains myriads of spores, it can readily be understood how each little piece of the leaf falling to the ground is an ingenious way of perpetuating the species and spreading it over a large area.

Treatment.

As already pointed out, several fungi are concerned in the production of shot-hole and scab, and may either occur simultaneously or successively, but a general treatment may be applied to the whole.

* *Clasterosporium carpophilum.*
† *Phyllosticta prunicola.*

1. Since the shot-hole fungi may occur on the shoots and fruits as well as on the leaves, the former should be removed and destroyed when found diseased. The object in doing so is to destroy the fungus in its early stages, and thus limit the spread of the spores.

2. Remove all dead wood from the tree at the pruning season, and burn it, since the fungus may grow and produce its spores there, and thus infect healthy parts.

3. Spray with Bordeaux Mixture, generally as for leaf-curl, and just before the bursting of the buds. At the North Carolina Agriculture Experiment Station an "entirely satisfactory remedy" was found in the copper sulphate-lime-molasses mixture, which consisted of 4 lbs. copper sulphate, 4 lbs. unslaked lime, 1 gallon of molasses, and 45 gallons of water.

PLATE I.

LEAF CURL.

Fig. 1.—Peach shoot showing thickening, distortion, blistering, and bright colouration caused by fungus.

Fig. 2.—Peach leaf showing mealy covering on upper surface formed by spores.

Fig. 3.—Young peach leaf beginning to curl.

Plate I

C. C. Brittlebank P. X. D. Mc Alpine Direxit

PLATE II.

"Shot-hole" and "Scab."

Fig. 1.—Plum-leaf riddled with holes and decaying at margin.

Fig. 2.—Young shoot of apricot showing early formation of "shot-holes" (ten days after bursting of bud).

Fig. 3.—Young shoot of peach showing "shot-hole" of leaf.

Fig. 4.—Portion of upper surface of Peach leaf showing brown spot ith perithecia of *Phyllosticta prunicola* on surface.

Fig. 5.—Small portion of same magnified showing superficial, globose, shining perithecia.

Plate II

C. C. Brittlebank P. X.   D. McAlpine Dirext

DODDER:
ITS LIFE HISTORY, LOCAL CHARACTERISTICS, DISTRIBUTION, AND REMEDIES.

By D. McAlpine.

There are a number of plants, just as there are also animals, which do not live in the ordinary way, but prey on other living bodies and obtain their nourishment at their expense. An organism living in this way is called a parasite, and the plant on which it preys its host. While it is among the lower forms of vegetable life, such as the fungi, that parasitism most frequently occurs, still, even among flowering plants, there are a considerable number which have developed this depraved taste, and of these one of the most famous, on account of its ravages, is the clover or lucerne dodder. This unwelcome visitor, when seen in the clover-fields at home, is the cause of great anxiety to the farmer, not only on account of the immediate damage it does, but owing to the difficulty of extermination after it has once gained a foot-hold. At the suggestion of the editor, who is writing an article on lucerne for the dairy farmer, I am giving an account of this destructive parasite, and the best-known means of prevention and eradication.

Name.

Dodder belongs to the same family as the convolvulus, and, while mostly attacking small plants, some American species coil round branches and grow at the top of the tallest trees. The lucerne dodder, with which we are now dealing, may grow on clover and other plants, and from its growing on thyme, as well as furze, grasses, nettles, &c., it has been scientifically named *Cuscuta epithymum.* The popular names given to it, however, are more expressive, if less elegant, such as hell-bind and devil's ringlets, and show the holy horror with which it is regarded by the growers.

Life-history.

In briefly sketching the life-history of this plant, from the germination of the seed up to the development of the flower and ripe seed again, only the more prominent features will be noticed.

The seeds germinate on the damp earth, or on decaying vegetable matter, or even on the rough bark of old trunks. They lie where they fall during the winter, and germinate the following spring, usually very late, at least a month later than the seeds shed at the same time. This late germination is of advantage to the parasite, since it will find young plants above ground around which it may twine. The young embryo plant is mainly developed above ground, for the tiny root is only formed sufficiently to absorb the necessary moisture from the soil to dissolve the materials stored up in the seed, and then it shrivels and dies. The root simply provides for the slender thread-like stem at its first start, which has not even leaves, and then perishes. If the stem in its circular movements meets with something to twine round, it is all right; but, failing this, it may lie on the damp earth for four or five weeks, waiting, Micawber-like, for something to turn up. Having

seized on some support, it moves round in a circle, like the hands of a watch, and firmly embraces its victim, seeking to reach the higher and younger parts as rapidly as possible, where nourishment is most easily obtained. At certain places the thread-like stem forms sucking organs, which penetrate the tissues of the host, just as the roots of ordinary plants penetrate the soil, and extract nourishment for its future growth. It thus becomes established, and its future assured, for whenever the first sucker is formed, then the parasitic life of the dodder begins. If there is no suitable plant convenient at first, such as the closely-planted clover or lucerne, which favours its spread, it can make use of weeds or grasses to serve as stepping-stones to reach the more succulent growths, and when once it has established itself in this way the part below the sucker dies. The dodder then goes on growing and twining round its victim, alternately firm and loose, until it has completely exhausted the plant on which it preys. The thread-like stems grow so abundantly that they form dense tangled masses of coarse reddish filaments which often completely smother the lucerne or clover. And in spreading from one host plant to another, the younger branches may, when they fail to reach a suitable support, lay hold of the older portions of the parent dodder, and thus become cannibals as it were. Towards the end of summer little tufts of whitish or pinkish flowers are formed in great abundance along different portions of the threads, and fruit-cases are ultimately produced, which open by means of lids, and the seeds are then readily shaken out by the wind. Thus the story of its life is completed; and, with returning spring, the seeds again germinate and carry on the process from year to year. But it must be remembered that the dodder, like many other plants, can multiply itself by means of detached portions, and that young and old shoots, if kept on damp earth, can grow and twine around living plants.

Local Characteristics.

In the great lucerne-growing districts of the State the dodder grows luxuriantly where it has been introduced in the seed, and at the present time (15th February) is covered with its numerous bunches of white flowers, which will soon produce seed. It forms extensive matted patches, and in a paddock of 5 acres I saw about 300 patches of the parasite. In fact, the splendid growth of the lucerne is accompanied by an equally luxuriant growth of the dodder, and the tall-growing lucerne is sometimes completely smothered in a tangled mass. In the evidence given by a Dublin seed merchant before the departmental committee appointed by the Board of Agriculture to inquire into the conditions under which agricultural seeds are at present sold, it was pointed out that there the presence of dodder seed in clover was not really serious. The witness said—"I am quite certain that there is a great deal of dodder distributed in Ireland, and I am quite certain that the quantity of dodder that we are growing, as a parasite, is very, very small. In fact, I think that I have only seen dodder three times in Ireland." On the other hand, the local conditions prevailing here are so favorable to the growth and germination of dodder that its introduction should be absolutely prevented.

Distribution.

This species of dodder is a native of the old world, and occurs in Europe, from Denmark southwards, West Asia, and North Africa. It is common in Europe, especially in Spain, Italy, France, Germany, and Hungary; but it is stated by Professor Lindley to have been imported into Britain from Afghanistan as late as 1843. Lucerne grows wild in Afghanistan, and the dodder may be native there as well. It has also been introduced into the United States, and is said to have been imported into California with lucerne seed from Chili. Its presence in Australia is also due to unclean seed, but there is no definite record of its first occurrence. Much of the lucerne seed is at present imported from America, and the plant has found a congenial home there.

Preventive and Remedial Measures.

In dealing with such a pest as the dodder, a number of precautions may be taken to prevent its introduction and spread, based upon the life-history which has just been sketched. It can be got rid of in various ways, such as burning it out by fire, smothering it either with a layer of manure, or covering it for 24 hours with water, or killing it by means of various preparations. But the best method of all is to prevent its introduction into our lucerne-fields by means of impure lucerne seed. It is recognised by every lucerne-grower that I have met that this is going to the root of the matter, and the sooner it is attended to the better. It is fortunate that the seed of dodder can be separated from lucerne seed by a careful process of sifting, on account of the difference in size. Dodder seed is roundish, brown to greyish-brown and dull, and seen to be finely granular when examined with a lens, whereas lucerne seed is smooth, shining, and yellowish-brown. The dodder seed is so small that it takes from 20 to 22 of them placed alongside of each other to cover 1 inch. If a little lucerne seed containing dodder seed is placed on a sheet of paper, the one can be readily separated from the other by gently inclining the paper. The light round dodder seeds run away at once, while the heavier lucerne seeds remain behind. The Royal Agricultural Society of England has for years recommended that its members should only buy seeds under a certificate or guarantee of purity and germination. Mr. Carruthers, F.R.S., consulting botanist to the society, has given, in his evidence before the committee already referred to, the order form and conditions of purchase and sale of seeds prepared for the society. In that form the following clause occurs :—"That the grass seeds are free from ergot, and the clovers free from dodder." I had occasion, some years ago, to examine rye-grass seed being sown in the Goulburn Valley, and found it badly infested with ergot. I reported the matter, and pointed out that, while I was endeavouring to the best of my ability to keep down fungus diseases, here was one being sown broadcast, but there was no authority to prevent it. The time is surely ripe for preventing the importation of such diseases into the State, even although it might be necessary, as suggested by M. Scribaux, Director of the Seed Experiment Station of the National Agronomical Institute, France,

"that all leguminous seeds be examined by the Customs officer, not only as to their origin, but also as to their freedom from dodder." There are always some who will buy even dirty seed because it is cheap, and such a measure would meet even that contingency.

The only prevention of the pest is to make sure of sowing only pure seed, but when it has made its appearance various means may be used for its eradication :—

1. Cutting the crop before the dodder matures its seed will prevent the land being re-infected.

2. Burning the patches as they appear is the plan usually adopted; and care has to be taken that it is done thoroughly, so that none escapes to grow afresh.

3. Removing the attacked plants just a little below the surface of the ground and burning is also adopted. The neck of the root or crown of the lucerne will soon grow, but the dodder, being a so-called air plant, will be destroyed. If the spots thus cleared are sprayed with a solution of sulphate of iron, at the rate of 1 lb. to 8 gallons of water, it will act as a stimulant to the lucerne.

4. It has been recommended to water diseased spots with a solution of sulphate of iron at the rate of 1 lb. to 2 gallons of water, or a 5 per cent. solution, but this has not always turned out quite satisfactory. It does not destroy the seed, and, therefore, it is useless to apply it after the dodder has seeded.

5. Smothering it with a layer of manure has also been effectually tried. The lucerne is cut away and carefully removed from the affected patch, as well as a little beyond, and then burnt. The cleared area is next strewn with manure to a depth of 6 inches after being trodden down. This method is applicable to small patches, but is evidently impracticable where large areas are affected.

6. Sulphuric acid has also been used for watering the attacked plants, at the rate of 1 in 200 to 300 of water. This application destroys the lucerne as well as the dodder, but it would clear the fields of this objectionable parasite.

In the first number of this *Journal*, Mr. Potts directed attention to what he called a briar and blackberry bush eradicator, in the shape of the waste sulphuric acid at butter factories, obtained after testing the milk samples by the Babcock method. This might also be used in dodder-infested fields.

7. A solution of arsenite of soda might be used for eradication, since it is very destructive to various weeds, and even to the prickly pear. A 1 per cent. solution might be tried, or 1 lb. of sodium arsenite to 10 gallons of water. It is easily made by taking the sodium arsenite and adding to it, in a kerosene tin, about 1 quart of water; then place it over a fire and heat until the arsenite is dissolved, giving it an occasional stir to hasten the process. Make up the arsenite solution with the proper amount of water, and it is ready for application. This is a poisonous spray, and it would be necessary to keep stock out of any paddock subject to this treatment; but after about a week the restriction might safely be removed.

8. It has also been recommended to spread thickly crude gypsum or sulphate of lime over the stubble after the second cutting, on a morning when the dew is heavy, with the promise of a fine day. Under these conditions the lucerne and dodder will appear brown next day, as if burnt ; then after about eight days the lucerne will recover, while the dodder will be killed. No dodder appeared the following year where this was tried.

9. Where a plentiful water supply exists, and the levels such that the land can be flooded several inches deep for 24 hours, and the water afterwards rapidly drained off, there is no more simple and efficacious method of destroying the dodder. As lucerne itself is easily killed by excessive watering, this plan should only be followed where efficient drainage can be secured.

Conclusion.

The measures above described are being practically tested to ascertain the simplest and most effective method of eradication suited to local conditions. Since the growth of lucerne, already an important factor in the success of the dairying industry, is likely to become considerably extended in the near future it is essential that every precaution be adopted to insure the freedom from disease of further sowings. Some arrangement might profitably be made by the Department for testing the seed supplied, and I understand reliable houses are prepared to supply seed guaranteed free from dodder at a slightly increased cost. Those who have been troubled with the pest are not likely to grudge the extra expense, but I wish particularly to impress upon all, especially the inexperienced, that in good clean seed alone is freedom from dodder to be obtained.

VEGETABLE PATHOLOGIST'S BRANCH.

BACTERIOSIS OF TOMATOES.

By D. McAlpine.

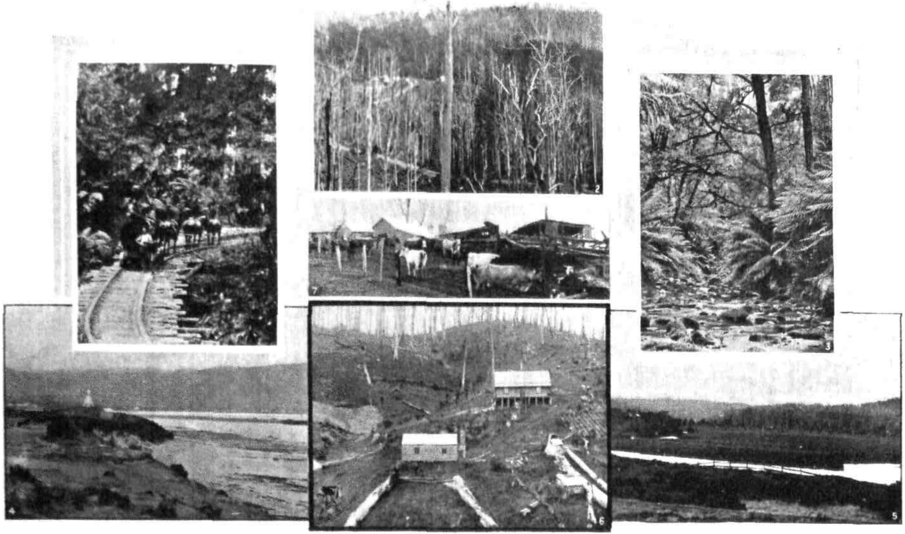
Tomatoes have been sent to me from various districts during the present season with a very characteristic appearance; and, as I understand that this disease is not at all uncommon, I will describe its nature for the benefit of growers generally. The tomato arrives at full maturity, but the blossom end is flattened, and instead of having the ordinary healthy skin, it is discoloured, and ultimately becomes of a pale olive tint. The discoloured skin is at first firm, smooth, and glossy, but it is sharply marked off from the red skin, and usually covers the entire upper surface.

On cutting the tomato lengthwise, the firm healthy part is distinct from the diseased part; the latter being more watery, and of a dark olive-green colour. A slimy matter is seen to exude, and on examination with a high power of the microscope it is found to consist of myriads of bacteria. Bacteria are so universally present that great caution has to be exercised in making them responsible for disease; but in this case the slimy mass of bacteria so permeated the tissues, to the exclusion of everything else, that they may be regarded as the authors of the mischief. However, diseased specimens have been sent to Dr. Cherry, at the Bacteriological Laboratory. I will infect the tomato fruit in its early stages with pure cultures of these micro-organisms. In some instances the plants affected were trained on stakes, so that the fruit was not in contact with the ground.

Treatment.

The principal measures to be adopted are :—

1. To destroy all diseased fruit as soon as it appears.
2. Not to repeat the crop in the same soil; and
3. To grow such varieties as are known in the district to be free from disease.



1. A Bluegum Log. 2. Dairy Farms on the Hills. 3. Wild Dog Creek.
4. Apollo Bay. 5. Cawood's Flat and Barham River. 6. Mr. Lurkie's Onion, Potato, and Dairy Farm.
7. Dairy Cattle.

APOLLO BAY.

By H. W. Potts.

In response to an invitation to visit Apollo Bay from the organizing committee appointed to look into the question of forming a co-operative butter factory company, I went there towards the end of January by the s.s. *Dorset*. The journey from Melbourne to the Heads is one of little interest, but on reaching the Pacific, and trending down the coast line to our destination the scenery became increasingly attractive. Passing Mount St. George the shores swerve round in a westerly direction, thence south-west until Cape Patten is reached. Here the curve of the coast line is gradually deepened, and eventually forms a pretty bay, terminating on its southern boundary at Point Bunting. Between these two conspicuous land marks lay this country, the productive capacity of which, from a dairying point of view, it was my mission to investigate. The tree-clad hills arising abruptly from the shore form a land wall composed of carbonaceous mesozoic rocks. The ranges are masses of rounded hills and slopes rising up like a continuation of old-fashioned pepper-boxes peering over each other, and reaching an altitude of from 500 to 1,200 feet. These spread northerly for 20 miles, and culminate in a point at Mount Sabine, 1,800 feet above sea-level. Along the tertiary slopes the persistent and sturdy efforts of the settlers tell their tale. Good soil is found right on to the summit of the ranges, and all the timber left standing is rung. Arriving at the pier, which stretches out into the bay into deep water, we are favored with excellent weather. During the prevalence of south-easterly winds it is unapproachable; fortunately this does not often happen. The township consists of two good hotels, post-office, police camp, store, and a few residences, but in the back-ground the homes of numbers of selectors peer cosily out from the dead timber.

A charming stretch of fine clear sand skirts the bay and bursts up the fury of the Pacific rollers. Behind this runs a series of hummocks and sand dunes, the shifting unruly vagaries of which have been permanently quelled by the planting of marram grass and spinifex. A number of creeks discharge their never-failing supply of pure cool water gathered from the springs in the ranges, and largely contribute to the romantic coast scenery. For picturesque variety the district can scarcely be surpassed.

Two rivers of some importance find an outlet in the neighbourhood —the Barham and the Elliott. The former is being made more useful by some expenditure in the direction of snagging, and thus rendering the possibility of floods on the rich flats more remote. A trip through the district with a genial and communicative companion in the person of Mr. Fred. Martin placed the possibilities of the district, from a productive point of view, in a truly favorable light. Formerly the hills, which embrace the principal grazing

country, were densely wooded with white and blue gum, with here and there specimens of messmate, beech, and blackwood. Amongst the undergrowth could be recognised the unerring testimony of rich land in dogwood and hazel, native olive, mulberry and blanketwood. Then again we suddenly stride on to poor land with its honeysuckle, tiger brush (or native box), ti-tree, bull oaks, heath, and spurious native hop (*Godenia ornata*). In fact, one settler graphically remarked "that here, as in South Gippsland, you may stand on a plot of ground worth £20 an acre and throw a stone on to land not worth 5s. per acre." Many features so prominent throughout this district are similar to South Gippsland. We learn of the dogged determination and pluck of the original selectors, few of whom are left, who attacked this dense forest. Ringbarking was conducted under the most disheartening circumstances.

When the trees died then a favorable opportunity was seized in the driest and hottest part of the summer to secure a good burn. This cleared the undergrowth and impenetrable scrub. The tales of what are known as good burns are related with a tinge of regret, seeing many lost their homes and fences in the uncontrollable fury of the fire blasts. One settler tells of how he has lost three homes, but the task of rebuilding was taken up again with cheerful vigour for the reason that excellent soil awaited the efforts of the farmer to repay tenfold the early losses.

As soon as the ground is cleared of scrub then cocksfoot, clover, and rye grass are sown. These grasses grow here in wonderful luxuriance all the year round. The farms range in size from 100 to 320 acres. Most of the houses and farm buildings are built on the hills, all of which are covered with a good depth of rich loamy soil and in many instances resting on marly clay subsoil. The small farms pay the best. It is impossible to secure labour to deal with large areas. The farmer has to rely on his own family to carry on dairying operations, and the growth of onions and potatoes.

The rainfall is a heavy one, and evenly distributed throughout the year ; the atmosphere is humid and comfortably cool. The natural climatic conditions favour intense culture in several forms. Most of the selectors back from the coast line carry on dairy farming ; the cows, however, are a mixed lot, and the highest returns I could ascertain were under £7 per head per annum. No effort is made to raise good stock. The sires are a wretched lot, ill-bred, and unsuitable. Very few good cows are to be seen. With suitable herds of better type the returns might be readily doubled provided a little more provision were made for special food and shelter in winter. As it is, the cattle are turned out after milking about six months. All the farmers own separators, make butter, pack in 56 lb. boxes, and take it to Apollo Bay for shipment to Melbourne. All the faults of dairy-made butter may be readily found here, and clearly point to the urgent need for the establishment of a butter factory. Many of the farms are situated back in the hills where it is difficult to secure good roads, and haulage necessarily is a serious consideration. But the rapid way in which the timber is being cleared,

with the excellent soil and climate, all point to better conditions and more intense culture. All the slopes are well grassed, and afford excellent pasturage for light cattle of the Ayrshire type.

Whilst among the ranges the impression was indelibly fixed in my mind that there is a great future before the settlers who have had the courage to isolate themselves under the most trying conditions, and are now emerging from times that have no pleasing features excepting to know that there is a good time ahead. Potatoes and onions are grown in square plots all through the hills. It is surprising to note the rich green mosaic patches peering through the dead timber hundreds of feet above sea level.

One special condition so favorable to dairying is the everlasting supply of deliciously cool and pure water found bursting out of the hills from springs in all directions, and forming mountain creeks. One settler pointed out five permanent creeks traversing his holding.

Several of the farmers have introduced that splendid pasture grass, the Kentucky Blue (*Poa pratensis*, Linn.), and do not hesitate to speak highly of it as a fodder. It is recognised that this grass attains its maximum nutritive value in regions where lime is abundant, and in this district combined in a loose friable rich loamy soil we find lime a predominating constituent. Amongst the several advantages successfully claimed for the grass is the ready facility with which it grows together, binds and forms a close aftermath, rendering it suitable for turfing banks, terraces, and slopes with a firm sod. It makes a desirable adjunct to the growth of permanent pasture, and is a nutritious and palatable fodder for cattle. In this hilly district it is found beneficial to sow it with cocksfoot, rye grass, and clover. One prominent farmer here, after some considerable experience, is confident that Kentucky blue grass may be applied as a deterrent to the growth of ferns (bracken). He cuts the ferns level with the soil, and sows the seed of this grass; it grows rapidly, knits well together, and forms a close sod, covering the prostrate root stock, and eventually kills the fern. These are only a few convincing illustrations known to the credit of this somewhat neglected, but useful grass.

In sowing it, fully 3 bushels of seed is required to an acre. This should not be covered, only rolled after sowing. Light and air are stimulating features in securing the fullest germinating power in the seed.

Many years ago the late Mr. Manifold, of Lake Purrumbete, introduced the English meadow fox-tail (*Alopecurus pratensis*, Linn.), and had it sown freely throughout the paddocks, where it became permanently established, and from thence it has spread and been distributed in the neighbourhood, chiefly through the agency of the local botanist, Mr. Mariner. Here at Apollo Bay on several of the dairy farms we find this hardy European grass fully justifying the good opinion held of it by its sponsor. On good soil it yields a large amount of highly nutritious fodder. In permanent pastures it may be looked on as one of the most lasting of the perennial grasses. Several farmers speak somewhat doubtfully about its value,

and possibly their impression is created through want of experience. It takes fully three years before it becomes well established; once that is effected, it is charcterized by an early and abundant growth of sweet and palatable grass.

Leaving the ranges we descend to the valleys and narrow gorges, and emerge on to the coast line. A number of rich flats were visited, small in area, but remarkably rich, and specially adapted for the growth of potatoes and onions. Here, as in other places we visited, the Yorkshire fog grass grows abundantly, but rightly it is not favoured by the stock-owner. The flat through which the Barham River flows is to be remembered when seen. Mr. Finlayson owns one patch of 40 acres, and it is leased at a rental of £2 an acre per annum for onion and potato growing to Mr. Dalley, who, with his son, have had many years' experience in onion cultivation at Bellarine.

The conditions are eminently favorable to onion growth when a proper system of cultivation is followed. There is some risk attached to it, but if the season is favorable and the markets good, the returns are worth the risk. Mr. Dalley furnished me with details of the cost of the crop as follows per acre:—

	£	s.	d.
Rent	2	0	0
6 lb. seed at 6s.	1	16	0
Tillage, ploughing, harrowing ...	2	0	0
Weeding, hoeing, clearing ...	6	0	0
Drilling (sowing)	0	5	0
Raking	0	6	0
Stripping and bagging	3	0	0
Bags	6	0	0
Carting to steamer	2	10	0
Freight, 10s. ton	10	0	0
Commission, 5 per cent.	5	0	0
	38	17	0

Last year they harvested 20 tons to the acre, and the average price realized was £5 a ton. Thus a profit of £61 an acre was made from a plot of 11 acres. In very favorable seasons as many as 30 tons per acre have been grown. So far no disease has appeared, and six crops are taken off in succession without any manure. On the sides of the hills four crops are got. The bulk of the farmers on the flats have small plots in, and altogether there are 108 acres in full bearing this season.

Complaints are made concerning the seed purchased from the seedsmen, hence they arrange to grow and collect their own in March. Sowing is conducted from July to September after rainfall. When early sowing happens to prove a failure, then there is time to sow again to catch the season.

The chief aim in growing onions is to keep the same crop growing year after year. Many people get disheartened with a bad season, but two good seasons will amply repay for a dead loss in the third. The profits, of course, are controlled by season and the market. When the latter gets as low as 50s. a ton, then there is nothing in the crop for the producer. Like wise men, the Apollo Bay land-owners do not

rely on one crop or one line of cultivation. Invariably where onions are grown we find a patch of potatoes, and the average yield is 10 tons per acre. Fruit-growing is also followed, and varieties of apples specially suitable for export are found to thrive and pay well here. The favoured types are Scarlet Nonpareil, Cleopatra, Five-crown, Sturmer pippin, and Rokewood's seedling. Along the flats, owned by Messrs. Tindall and Cawood, we find them utilized for fattening cattle, and it almost seems incredible the returns per acre alone from beef. One of the staple industries of the place is that of dairying, but so far it has been conducted in anything but the most profitable manner. The farmers realize this, and are taking an interest in the subject. In such a small place it was surprising to find an audience of 130 persons, on a wet night, at the illustrated lecture I gave in the Mechanics' Institute. The question of building a butter factory has been seriously considered, and active steps have been taken to start a local co-operative company. All the conditions are favorable to the success of the venture, the small farms, the rich soil, and excellent rainfall are such as to give the best encouragement, and, given a better class of cows, pure bred sires, improved roads, and a butter factory centrally situated, with facilities for collecting the cream from the farmers along the face of the hills, there is no reason why the Apollo Bay district should not rival our best Gippsland and Western districts in the quality of its butter.

The following produce was shipped from the Bay by the s.s. *Dorset* during the year 1901 :—

7,227 bags onions.	363 cases fruit.
1,278 bags potatoes.	21 cases tallow.
17 bags peas.	33 bundles skins.
6 bags garlic.	124 hides.
193 baskets fish.	26 bales wool.
50 packages crayfish.	884 cases butter.

1,560,000 superficial feet timber, bluegum chiefly, from the Apollo Bay Timber Company's saw-mills on the Elliott River.

The saw-mills owned by the Apollo Bay Timber Company conduct extensive operations within 4 miles of the township, and supply quantities of bluegum timber of excellent quality, chiefly for contracts entered into with the Harbors and Rivers Department.

Seeing the initial difficulties of settlement are practically surmounted, the land-owners and selectors are now awakening to the necessity for converting such rich land, with all its climatic advantages, to better use. It is a safe forecast to assert that Apollo Bay will soon be looked on as one of the rich gems of agricultural development in the State.

CHIEF INSPECTOR OF STOCK'S BRANCH.

HINTS ABOUT DAIRY CATTLE.

By J. R. Weir.

Now that almost every farm is a dairy, I think it well to point out what must have struck every observer, viz., that the greatest mistake the majority of owners make is to go in for quantity instead of quality.

In some cases five cows are kept to the one on the adjoining farm, but the returns are equal, the good ones producing five times as much as the bad ones, although the labour and keep is five times as much on the former.

On the place with the smaller number everything is cheerful, whilst at the other grumbling is the rule. Where a lot of ill-bred half-starved animals are kept it is usual to find everything else to match; but where care is exercised in breeding, feeding, &c., where a valuable strain is perpetuated, how different things are—all is prosperous.

In starting a dairy herd my advice is to buy good young sound cows.

The breed does not so much matter so long as they have the essential qualities—good-shaped healthy animals with big bodies and short legs, and heavy and rich milkers. The bull should, however, be a pure animal of a recognised milking strain, and above all should be hardy and healthy.

The usual cry is to improve the breed. While every one will admit that is correct, it is even more desirable to improve the feed, and to supply shelter from heat and cold, and warmth in winter, when the cows should either be housed or rugged. It should be remembered that warmth is as necessary in cold weather as food, and it takes a lot of food to supply the warmth which can be done by either housing or rugging. The latter plan has been found, where-ever tried, to be very beneficial.

There is a great deal of cruelty practised by dairy farmers, and often the constitution of the cow is ruined as a calf through semi-starvation. At a few weeks old the calves are turned out to live or die. In many cases they live, and become as miserable looking cows as they were calves.

Where milk is the main object, and it is all or nearly all disposed of, would it not be wiser to keep only the calves from the best cows, and feed them thoroughly, especially while young, than to keep all, including the steers from Jersey bulls?

Provision should be made in the time of plenty for the time of scarcity. Ensilage could be made, green-stuffs grown, and straw-stacks preserved. Bran is a splendid food, and saves the lives of more cows than medicine. It can generally be bought at a reasonable rate, and soon repays the outlay.

Another most important factor to be studied is the water supply. Water-holes should be cleaned out regularly at intervals, and if there is a want of lime in the lands the cattle graze over, then it should be put into the water-holes, and the land covered with manure containing the necessary phosphates.

Each year a number of reports come to hand of cattle dying from what is styled by the owners a mysterious disease, but on investigation it nearly always turns out to be from the same cause—want of nutrition—and that the farmers alone can supply.

Often the land is deficient in properties that can inexpensively be artificially supplied. Information on soil deficiencies and the methods of replacing them can be obtained on application to the Agricultural Chemist.

Heavy losses have recently occurred in one district, where a veterinary surgeon was sent to inspect, and the result of his investigation has proved the want to be salt, and where it was given no losses had taken place. Salt is fortunately cheap enough, but unfortunately many owners are too careless to even supply it to their animals, although all know how fond they are of it, and how essential it is to the health of both man and beast. Bone meal is another valuable article to supply cattle kept on country known to have deficiencies. It can be given with salt at the rate of about 4 to 1.

In concluding this article, let me strongly recommend all owners of dairy stock to only keep as many as they can feed thoroughly—both by pasture and tillage, and those they do keep let them be of the best quality, because it costs as much to feed a bad one as a good one, and there is the same labour in bailing each up.

REPORTS OF INSPECTORS OF STOCK.

Bairnsdale, 2nd January, 1902.

YEARLY REPORT IN REFERENCE TO THE GENERAL CONDITION AND HEALTH OF STOCK IN THE NORTH GIPPSLAND DISTRICT DURING THE YEAR 1901.

To J. R. Weir, Esq., Chief Inspector of Stock, Melbourne.

Sir,

I have the honour to place before you my annual report for the year just completed. On the whole, the past year has been a favorable one for the farmers and stock-owners, prices being high for all classes of stock and produce, with the exception of inferior wool.

The stock in the district have been fairly free from disease. In cattle there have been a few cases of pleuro-pneumonia, but the disease has never made any headway, and the losses from this cause have been small. I have always impressed on cattle-owners the necessity of prompt action in dealing with this disease, as I have found, from experience, that where this practice is carried out there are few losses: Either isolate or destroy any rich beast the minute it is noticed; in cases of pleuro inoculate at once, and the chances are there will be no further trouble. On the other hand, if the beast is left in the mob it means more being affected, and, perhaps, heavy loss. In the case of milking cows the inoculation does not interfere with the flow of milk.

Tuberculosis I do not think is on the increase. We hear more about it now than in former times, but this is because it is only of late years that people have found out what the disease really is. It has been always with us, but went by other names, such as dry pleuro and wasters; most of the cases are in old cows, but it is not confined to any class of cattle; certain breeds seem more subject to it than others, and hardship and change of climate seem to develop it in favorable subjects. Actinomycosis and lumpy jaw are more frequent than in former years, and there have been few cases of cancer.

The heaviest losses have been in calves, "black-leg" carrying off a large number in the Heyfield, Glenmaggie, and Upper Maffra districts. These districts had all been swept by bush fires the previous season, and when the autumn rains came there was a wonderful growth of succulent grass, and this may have had something to do with the disease appearing there. I have known the disease in Gippsland for over twenty years; it may appear at any time, but generally comes after Christmas in a good season, carries off a number of calves in some particular locality, and then disappears, perhaps, for four or five years. Shifting the stock to poorer pasture sometimes stops it; if this cannot be managed, driving them up and down the roads for a few days is a good plan. Bleeding from the neck is also resorted to; and inoculating with garlic is also favoured by many.

There is also a lung disease in the hand-fed calves which has carried off a good many. It seems to be a form of pneumonia, and I think is brought on by damp and exposure in calves badly fed and badly sheltered; in other cases it is caused by lung worms (classed by Dr. A. A. Brown as *Filaria bronchialis*), the lungs are discoloured in patches, and on cutting into them small nests of thread-like worms are found. Dr. Brown recommended the administration of oil of turpentine, carbonate of ammonia, and nitrous ether, but it is hard to get farmers to try it, and in cases were they have done so they do not seem to think it has done any good. I think the remedy is to keep the calves strong and well fed, and they can defy these parasites.

In pigs there has been some disease, principally in the Orbost district, of which I reported to you last month. The most serious of these is locally known as the pants or heaves, and (the symptoms are very similar to the lung worms in the calves) this disease was bad in the Lindenow district, but has been almost done away with by care in the management and feed of the animals.

Sheep have been healthy, and a dry season favours them in Gippsland. I have seen very few with fluke; the young sheep suffer from worms, but by drenching once or twice in the season they thrive all right. The low prices for inferior wool has brought it home to owners that they must improve their flocks. Up to the present most of the sheep in this district have been neglected, and were mostly very inferior cross-breds and comebacks, very uneven in both wool and carcass, the wool in some cases hardly paying the expense of shearing and marketing. Portions of the poor forest country around here which was almost useless for cattle grows good sheep, and a number of very fine lambs have been sold this season for freezing. Cattle kept in this forest country for any length of time always suffered from cripples, particularly young cattle and cows rearing calves; but the sheep seem to thrive, and also improve the country.

Horses.—There has been no disease among this stock. Strangles has been prevalent in the young horses, but not in a very bad form. Stringhalt is seen now and then, but is not so prevalent as in former years. Horse breeding is on the increase since the demand has been so keen for South African and Indian remounts, and stallions are to be seen everywhere—draughts, ponies, and thoroughbreds—some of them of a very inferior stamp; but, as these in many cases stand at a fee of £1, they are well patronised, notwithstanding the fact that many of these entires could never be expected to get anything but stunted mongrels. A good heavy tax might do away with a lot of these rubbish, but a small one would have no effect. If it wer possible to prevent the good young mares from being sent out of the State it would tend more to improve the general standard of our live stock than anything. This might be limited by a good export tax on all mares sent out of the State to India or elsewhere.

The season in the lower portion of this district has not been a bad one, but in the higher portions—Omeo and Bendoc—it was very severe. There was no autumn rain and a very severe winter, with heavy losses in stock. In the Omeo district there must have been a loss of not less

than 4,000 cattle, besides sheep and horses; and there were also many losses at Bendoc. Crops of all kinds have been good, and have been got in without any damage from insect pests or wet weather. The long spell of dry weather is telling on the milking cows, and the quantity of milk supplied to the factories and creameries is falling off very fast.

I have the honour to be, Sir,
Your obedient servant,
H. R. MACKENZIE,
Inspector of Stock, Bairnsdale.

Geelong, 15th January, 1902.

To J. R. Weir, Esq., Chief Inspector of Stock.

Sir,

I have the honour to furnish the usual yearly report.

As stated in my last half-yearly report, rains were late and scanty in the western district; in the northern areas there was no rain to speak of. In many places no fall of any value occurred until September, or even October, this happening where the good winter seasons are of so great importance, to secure which early autumn rains are absolutely necessary. Consequently, the result has been disastrous; instead of a season of six months' good grass, they have had only about two months'. A large number of lambs succumbed owing to the ewes having insufficient feed; the milk yield has been correspondingly smaller, and farmers have cleared off all surplus stock in anticipation of a worse time following, which bids fair, in default of early rains to start the stubble, to be realized.

In the western district, owing to the scarcity of grass in the winter, and the practice of over-stocking prevailing, the cows got very low in condition, and it was so late in the summer before they recovered that the milk yield has fallen considerably below the average, a condition of things which, in conjunction with high rents, is pressing very hard on the dairy farmers. One good result, however, may accrue, and that is that the importance of providing shelter and hay for winter feeding has been brought home to them. The high prices that ruled for hay of late tempted many farmers to part with what should have been kept for home use; the result has been a bitter experience, and I do not think it is likely to be repeated for a year or two at any rate. I have never failed to point out the advantage of feeding hay in the moist districts where the grass is soft and watery in the winter. In country of that nature the cows scour from spring throughout the winter, and up till the time the grass has some substance in it; a little hay corrects that condition by prolonging digestion, retaining the food in the alimentary tract until the animal gets the benefit of it. Rugging has been adopted by some with satisfactory results, and it is to be hoped that the practice will become more general. It is only by adopting these methods, refraining from overstocking, and by manuring the land, that the dairying industry will continue to be the profitable undertaking it has been.

Dairymen must not expect that the results first obtained from good land, which, in the past, has been lightly stocked with fat stock, will be continued under the conditions of overstocking with milking cows, which are harder on land than fat bullocks, unless some of the material obtained from the land is returned to it in the shape of manure. Milk cannot be continually taken from land without impoverishing it any more than crops of grain can. In the drier districts protection from the cold winds is necessary; in ordinary seasons feeding hay is not so necessary in the winter, but the provision of green fodder is as essential there in the summer as hay in the winter in moister climates. The difficulty is that, without some system of irrigation, it is almost impracticable; without water the hardiest of green fodder crops will make but a poor growth, scarcely paying for the labour expended.

As is usual when stock are poverty stricken, parasites flourish, and this brings forward the question of making the dipping of sheep compulsory. Were that done large owners would be greatly benefited. As things are now, although they may dip their sheep, they are liable to be infected by their neighbours who do not dip.

The prospect of having a Brands and Earmark Act passed shortly is viewed with satisfaction by stock-owners.

The "Yambuk disease" has caused the death of large numbers of cattle. I am afraid that in the event of another bad season being experienced the mortality will be still heavier. In season and out of season I have pressed upon owners the importance of adopting preventive measures, but it is hard to convince them of the danger or to go to any expense for a preventative; even when they have suffered loss they are disposed to trust to luck as far as a recurrence is concerned.

Pleuro pneumonia has broken out in several herds during the year, but has not been so prevalent as last year. It would be easier to cope with if owners would immediately isolate any sick beast, even if they were not sure of the nature of the sickness. As it is, farmers in their ignorance allow affected animals to mix with the herd, which is yarded twice a day, until a number are infected; the wonder is that more are not so. They then are surprised that inoculation does not forthwith stop it, as is usually the case in cattle not so frequently yarded, where the infected beast isolated itself, natural instinct prompting the others to keep at a distance.

Tuberculosis.—The herds are comparatively free from this disease. Farmers are beginning to realize the importance of destroying affected animals. They, as a rule, do not hang on to a delicate cow as they did.

Actinomycosis.—This disease is the most prevalent of all, most cases of reported tuberculosis proving to be of this nature; and it needs to be impressed upon owners that it is dangerous to the herd to allow the abscesses to discharge the contents over the pastures. They should be evacuated, and the contents caught on an old bag and burned, the sack being syringed out with an antiseptic.

I have the honour to be, Sir,

Your obedient servant,

W. J. COTHER, G.M.V.C.,

District Superintendent of Stock.

STATEMENT showing Number of Dairy Cattle Inspected for Year ending December, 1901.

Month.	No. Inspected.	No. Milking.	Pleuro.	Tuber-culosis.	Other Diseases.	No. Killed.	No. Isolated.
Brought forward for half-year ending June	5,227	3,567	29	3	9	21	18
July	1,070	241	...	...	1	...	...
August	865	460	...	1	3	2	2
September ...	453	362	2	1	1	2	1
October	270	270	4	...	1	3	2
November ...	855	771	6	...	...	6	...
December	1,109	808	9	...	3	4	8
Total	9,839	6,479	50	5	18	38	31

STATEMENT showing Number of Cattle other than Dairy Cattle Inspected during Year ending December, 1901.

Month.	Number Inspected.			Pleuro.	Tuber-culosis.	Other Diseases.	No. Killed.	No. Isolated.
	Cattle.	Sheep.	Pigs.					
Brought forward for half-year ending June	13,968	98,224	3,791	4	5	7	12	4
July	2,103	15,408	824	...	3	3	5	1
August	1,925	15,106	735	1	...	6	6	1
September ...	6,366	28,134	1,324	...	4	2	2	4
October	1,253	17,771	...	...	...	2	2	...
November ...	1,568	7,290	269	...	1	2	3	...
December ..	846	15,084	...	...	...	...	...	...
Total ...	28,029	197,017	6,943	5	13	22	30	10

REPORT BY J. E. BATCHELOR, INSPECTOR OF STOCK, SERVICETON, OF INSPECTIONS MADE, AND INFORMATION GIVEN ME BY FARMERS AND GRAZIERS IN THE PARISH OF LEEOR, AND SUCH PORTIONS OF THE PARISHES OF LILLIMUR AND DINYARRAK VISITED DURING THE PRESENT MONTH.

Dairy cattle inspected during the month, 81, the whole of which were in good health and all in good condition; 198 other cattle, including eight fat cattle, purchased for sale in Adelaide, were also in good health; in fact, there were many prime fats among them.

Cattle and Sheep Inspected and Diseases found, and how dealt with.—Cattle inspected, 279, and 27,886 sheep, and cannot discern any sign of disease, nor have I heard of any.

Diseases in Poultry.—Have seen upwards of 2,500 poultry in my course of inspection, all seeming in perfect health, and inquiry from owners fail to ascertain the presence of poultry tick in their flocks; in fact, none seem to know what tick is.

General Report of Diseases of all kinds of stock, and those most prevalent; also pests, whether animal or vegetable.—At the present time all stock seem free from disease of any kind. Impaction is, I believe, prevalent in this district some years, but I have not heard of any cases occurring lately. Actinomycosis is sometimes found occasioned by the entrance of the ray fungus, through abrasions in the

mouth, made by the hard dry fodder in the latter end of summer. As dipping is resorted to by the larger flock masters in the district, tick in sheep is held in subjection. I have heard but very little of it, only among those who are either lessees of scrub blocks, or whose land is adjacent to the scrub. No case of stringhalt has come under my notice in this district. Some two months since I saw a case of strangles of rather a complicated nature; it yielded to inhalation of eucalyptus, and fomentation of the swollen region with hot water.

Pleuro-pneumonia.—Not known in this district; there has never been a case of it, so far as I can glean.

Breed of Cattle most favoured.—Farmers in this district do not appear to favour any particular breed, but the cattle seem to be a cross between the Jersey and Ayrshire.

Milk Yield.—No attention is bestowed on this point, but, in so far as I can ascertain about 2½ gallons per day is about the average; the milk is used by the owners, either as milk or butter, not sold, and no test of its butter-fat yield is taken. The quantity above given as the average is for the spring time, when cows and grass are at their best. In winter some few feed the milch cattle on hay chaff.

Diseased Udders.—I have neither seen nor heard of any here.

Condition of Dairies, sanitary or otherwise.—Dairies here are excavations in the ground, with clay or thatched roof; and all that I have visited are cleanly kept, and with adequate ventilation; as but little milk is in them at once, no difficulty is experienced in keeping them sweet and clean.

Anthrax.—No case has been known.

Condition of Stock.—At present the stock in this district is in good condition, but, as the grass gets drier, and the stubble lands cleared up, they will fall away.

Grass and water are both plentiful at present, the high winds prevalent here will soon scatter the dry grass, and should an early downpour of rain (in, say, March or early in April) not take place, so that the grass may get a start before the frost sets in, feed will be very scarce. Water is conserved by the farmers in dams for stock, and should these give out in any case stock will not have to be driven more than 3 miles to water in the parishes reported herewith as deep wells, from which the water is pumped by wind-mills or large dams, provided by the Water Trust, and as abundant troughing is provided at each of these watering places, and in the case of dams, a powerful pump or water-lifter is erected, the owners are enabled in a short time to water their stock. Stock are excluded from the tanks by post, rail, and wire fences, so the supply is always pure. The crops, taken on the whole have been fairly good this season, and would have been better but for a very hot day which so fell as the milk was in grain in many cases, but in every case reducing the yield more or less. Subjoined are given acreage and yield.

Dinyarrak, portion visited, acreage under cultivation, 1,085. Distributed as follows:—

Wheat,	792 acres;	average yield,	11·9 bushels.
Oats,	117 „	„	23·7 „
Wheat and oats, cut for hay,	176 „	„	15 cwt.

Highest yield of wheat 5 bags, of oats 8½ bags, per acre.

Leeor, and portion of *Lillimur* visited, acreage under cultivation, 1,340. *Distributed as follows:*—

Wheat,	772 acres;	average yield,	7·78 bushels.
Oats,	295 „	„	16·23 „
Wheat and oats, cut for hay,	273 „	„	12 cwt. per acre.

Highest yield of wheat 4 bags, of oats 7 bags, to the acre.

Varieties of Wheat grown, bluey and purple straw.

„ Oats „ Algerian and grey dun.

Grasses favoured (native).—No particular grass is favoured. The prevalent food for stock is a species of wild oat, native barley, spike grass, silver grass, and a little native couch or umbrella grass, and on fallow land and stubble paddocks, the milk or sow thistle. Farmers favour for grazing purposes the land which has been broken up and cultivated.

Lambing.—In the parish of Dinyarrak the average was 72 per cent.
At marking „ Leeor „ 63·01 „

The lowness of the percentage in Leeor may be accounted to the weak state of the ewes, the lack of shelter in paddocks and, in the vicinity of the scrub, to killing by foxes.

Fodder.—With the exception of small areas of barley, not exceeding in altogether 5 acres, nothing is grown for stock. Dairying is not practised in the districts visited. The chaff from the strippers is saved and put under cover for feeding stock during winter. Lucerne and rye grass have been tried but were a failure.

Irrigation.—None. Not sufficient water available.

Best time for Sowing and Fallowing.—The universal opinion among the farmers in the district visited by me is that the months of July and August are the best for fallowing, May being considered the best month for sowing, if there has been sufficient rain to give the ground a soaking; good crops have been obtained when sown as late as August.

General Résumé.

The land in this portion of the district is highly charged with lime, in consequence of which, when the warm weather sets in, it opens up in great cracks on the banks of the crab-holes, of which the flat country is entirely made up. It is interspersed with red ironstone rises and sand hills, on some of which latter a variety of pine grows. On a chain of sand hills, about 3 miles from Serviceton, some 40 acres are planted with vines and fruit trees. At one time there was a much larger population in the district, but from some reason or other three-fourths of the original holders have lost their selections. The greater portion of the land has been cleared and cultivated, and merino sheep of fine quality now graze on what was at one time under grain. The country out from the scrub is lightly timbered with bull oak, mallee box, and gum timbers. A great deal too much timber has been taken from the land; the stock have not sufficient shelter from the wind and rain in winter, and the heat in summer.

The last crops were grown when artificial manures were used.

STATE BUTTER COMPETITIONS.

New Regulations.

The following new regulations have been made for the export butter competitions for prizes offered by the Department of Agriculture, in connexion with the export trade to ports beyond Australasia. These regulations will come into force for the next season's supplies :—

1. For the purpose of these competitions the State will be divided into four districts, called the "Western," "Northern and Wimmera," "North-Eastern and Central," and "Gippsland" districts. The "Western" district will include the whole of the south-western part of the State south from Meredith, on the Geelong-Ballarat railway line, and Maroona, on the Ararat-Hamilton railway line. The "Northern and Wimmera" district will include all factories in the Goulburn Valley, Rochester, Bendigo, Castlemaine, Maryborough, Mallee, and Wimmera districts. The "North-East and Central" district will include the Upper Murray, North-East, Kyneton, and Ballarat districts, to the boundaries of the "Western" and "Northern Wimmera" groups. The "Gippsland" district will include all factories east of Melbourne and south of the Dividing Ranges.

2. Prizes as follows will be given for the best butters exported from each district, together with champion prizes for winners of three certificates :—

Prizes { First, £12 10s., with certificate.
Second, £7 10s.
Third, £5.

Champion, gold medal.

3. Factories manufacturing butter in each district, and exporting same, will be treated as one competitor, irrespective of the number of creameries, or brands they employ.

4. The competition will be voluntary. Formal entries will be received at the beginning of each season. No entry fees are required.

5. In the event of a competitor shipping more than one brand of butter from any district, the average points awarded to the several brands will be taken into account in compiling the result.

6. Competitors sending to the Cool Stores for shipment less than four consignments per month for the months of October, November, December, and January shall not participate in any prize.

7. A sample box may be taken from competitor's consignment during the months of October, November, December, and January, and detained for the purposes of this competition.

8. One box of each brand will be detained each month, then examined by the judges, and points allotted on the basis of comparative money value (on the assumption that a perfect butter is worth 100 points) in the manner following :—

Flavour, including aroma	50 points.
Texture, embracing moisture	30 "
Condition, taking in packing and finish ...	20 "
Total	100 points.

Samples will be taken for chemical analysis and bacteriological examination. The boxes of butter will afterwards be placed in Cool Store for six weeks, and kept at a temperature below 32 deg. Fahr., at the end of which time the butter will be kept at a temperature of 60 deg. Fahr. for two weeks, and then finally examined and judged.

9. The prizes will be awarded to the competitors securing the highest average number of points in the final judging.

10. Three judges, appointed in the following manner, will act:—One selected by the competitors, one by the agents, and one by the Department of Agriculture.

11. If found necessary, butter will be paid for according to arrangement made with shippers before the export season begins.

E. G. DUFFUS,
Secretary for Agriculture.

CLASSIFICATION OF BUTTER Exported direct by each Country Factory for Seasons 1900-1 and 1901-2.

No.	1900-1.	1901-2.	No.	1900-1.	1901-2.	No.	1900-1.	1901-2.	No.	1900-1.	1901-2.	No.	1900-1.	1901-2.
1	98·12	98·12	31	96·40	96·55	61	95·66	95·96	91	94·50	95·56	121	92·93	93·12
2	97·88	97·56	32	96·38	96·75	62	95·64	—	92	94·36	95·11	122	92·90	93·23
3	97·80	97·67	33	96·37	95·77	63	95·63	95·14	93	94·29	93·92	123	92·81	93·55
4	97·79	97·96	34	96·34	95·95	64	95·61	97·00	94	94·25	—	124	92·78	92·72
5	97·74	97·65	35	96·31	96·98	65	95·60	—	95	94·23	95·85	125	92·65	91·58
6	97·67	97·98	36	96·30	96·63	66	95·59	95·91	96	94·22	94·43	126	92·60	—
7	97·66	97·94	37	96·28	—	67	95·56	96·32	97	94·22	95·55	127	92·45	93·30
8	97·58	97·81	38	96·28	97·27	68	95·52	—	98	94·22	94·62	128	92·38	92·28
9	97·58	96·86	39	96·26	97·00	69	95·50	96·17	99	94·21	95·38	129	92·25	92·13
10	97·57	97·90	40	96·23	96·73	70	95·45	95·95	100	94·06	95·95	130	92·20	92·73
11	97·49	97·39	41	96·21	95·59	71	95·44	95·94	101	94·04	—	131	92·14	93·00
12	97·48	97·79	42	96·18	96·87	72	95·42	95·31	102	94·03	93·88	132	92·08	92·41
13	97·47	97·49	43	96·14	97·00	73	95·38	96·12	103	94·00	92·00	133	91·49	—
14	97·35	97·78	44	96·14	97·42	74	95·36	95·97	104	93·90	94·68	134	91·29	93·29
15	97·30	97·11	45	96·08	96·97	75	95·28	96·32	105	93·85	93·26	135	90·00	92·53
16	97·28	97·38	46	96·06	96·33	76	95·16	95·80	106	93·77	95·07	136	90·00	—
17	97·22	97·29	47	96·03	96·43	77	95·15	95·50	107	93·76	93·69	137	—	—
18	97·18	96·81	48	96·01	94·62	78	95·12	94·55	108	93·76	95·27	138	—	97·86
19	97·16	96·95	49	96·00	95·23	79	95·00	94·66	109	93·71	—	139	—	95·35
20	97·11	97·20	50	96·00	—	80	94·99	—	110	93·62	94·48	140	—	96·54
21	96·97	97·10	51	95·97	96·05	81	94·93	94·66	111	93·56	93·00	141	—	95·89
22	96·94	96·76	52	95·96	96·65	82	94·92	95·52	112	93·47	93·26	142	—	95·49
23	96·87	97·82	53	95·90	95·57	83	94·85	94·46	113	93·37	93·79	143	—	95·03
24	96·80	97·13	54	95·90	96·42	84	94·82	94·80	114	93·33	93·19	144	—	93·87
25	96·66	97·25	55	95·85	95·64	85	94·77	95·00	115	93·30	93·42	145	—	93·80
26	96·56	97·32	56	95·77	97·27	86	94·73	—	116	93·26	—	146	—	93·06
27	96·54	96·00	57	95·76	95·64	87	94·60	96·25	117	93·05	—	147	—	93·00
28	96·50	97·01	58	95·75	96·05	88	94·60	95·01	118	93·03	91·88	148	—	92·86
29	96·48	96·85	59	95·70	97·12	89	94·57	94·00	119	93·00	93·33	149	—	92·85
30	96·42	95·88	60	95·69	—	90	94·56	—	120	92·97	92·00	150	—	92·27

Average points for Season 1900–1 = 95·28.

" " " 1901–2 = 95·57.

A mean average gain of ·29.

The order of merit is as follows:—No. 1, first; No. 6, second; No. 4, third. Then Nos. 7, 10, 138, 23, 8, 12, 14, 3, 5, 2, 13, 44, 11, 16, 26, 17, 38, 56, 25, 20, 24, 59, 15, 21, 28, 39, 43, 64, 35, 45, 19, 42, 9, 29, 18, 22, 32, 40, 52, 36, 31, 140, 47, 54, 46, 67, 75, 87, 69, 73, 51, 58, 27, 74, 61, 34, 70, 100, 71, 66, 141, 30, 95, 76, 33, 55, 57, 41, 53, 91, 97, 82, 77, 142, 99, 139, 72, 108, 49, 63, 92, 106, 143, 88, 85, 84, 104, 79, 81, 48, 98, 78, 110, 83, 96, 89, 93, 102, 144, 145, 113, 107, 123, 115, 119, 127, 134, 105, 112, 122, 114, 121, 146, 111, 131, 147, 148, 149, 130, 124, 135, 132, 128, 150, 129, 103, 120, 118, 125.

PARTICULARS OF FROZEN PRODUCE exported from Victoria for February, 1902.

—		Through Government Cool Stores.	Through other Cool Stores.	Total Quantity Shipped.
Butter (Victorian) ...	lbs.	235,480	41,440	699,620
„ „ (tinned) ...	„	...	422,700	
„ (Inter-State) ...	„	31,976	...	31,976
Cheese	„	...	9,000	9,000
Milk and Cream (concentrated)	cases	1,662	55	1,717
Poultry—Chickens ...	head	9,180	1,515	10,695
„ Turkeys ...	„	80	...	80
Eggs	dozen	11,160	750	11,190
Lamb and Mutton ...	carcasses	14,369	32,213	46,582
Beef	„	...	48	48
Calves and Pigs	„	25	...	25
Veal	sides	72	...	72
Forequarters of Mutton ...	...	392	...	392
Rabbits	pairs	265,270	52,212	317,482
Hares	„	16	...	16
Fruit	cases	1,357	...	1,357
Fruit-pulp	„	2,457	...	2,457
Sundries	lbs.	2,740	3,800	6,540

1st March, 1902.

STATEMENT showing Quantities and Average Prices for best quality of Butter exported to Great Britain from Victoria for corresponding periods in the busiest part of the last three seasons.

Shipped for Week ended	1901-2.			1900-01.			1899-1900.		
	Quantity.	Price.		Quantity.	Price.		Quantity.	Price.	
	cwt.	s.	d.	cwt.	s.	d.	cwt.	s.	d.
Oroya, Sept. 17 ...	1,561	120	0	5,180½	112	9	3,642	105	5
Himalaya, „ 24 ...	1,774½	115	2	5,696½	109	0	9,708	101	8
Ormuz, Oct. 1 ...	3,103½	113	10	6,481½	107	1	8,877	102	7
China, „ 8 ...	3,175½	113	10	9,278½	108	0	11,049	104	4
Oruba, „ 15 ...	3,107	113	3	4,777	111	9	11,272½	105	1
Arcadia, „ 22 ...	10,092	110	6	11,790½	111	9	11,902½	104	9
Austral, „ 29 ...	8,694	106	8	11,658	111	6	13,658	104	8
India, Nov. 5 ...	9,807	106	4	12,064	110	2	13,795½	101	7
Cuzco, „ 12 ...	5,037	105	8	16,780½	111	4	12,400	101	0
Oceana, „ 19 ...	12,370	106	4	16,047	108	6	9,415	100	0
Omrah, „ 26 ...	11,992½	108	0	12,044	113	0	11,313	98	2
Britannia, Dec. 3 ...	9,461	106	9	10,853½	112	0	8,224½	97	2
Ortona, „ 10 ...	8,880	108	0	12,103	108	4	15,956½	96	10
Australia, „ 17 ...	8,020	108	6	11,115	108	2	18,600	100	4
Orizaba, „ 24 ...	6,480	109	3	9,210½	108	7	10,547½	100	8
Victoria, „ 31 ...	4,980	111	6	7,013½	110	0	13,795	98	0
Oroya, Jan. 7 ...	4,003	112	0	2,406½	107	6	4,874	100	0
Rome, „ 14 ...	1,736½	...		4,896½	104	0	11,282	97	0
Ormuz, „ 21 ...	634	...		16,106	104	0	5,834	96	0
— „ 28 ...	...	...		5,767½	106	0	4,853	93	4
— Feb. 4 ...	...	...		4,366½	104	0	3,790	93	4
— „ 11 ...	...	...		2.907	104	0	4,263½	92	6

28th February, 1902. R. CROWE, Dairy Expert.

THE RAINFALL IN VICTORIA.

By P. Baracchi.

The table on next page shows the amount and distribution of rainfall over the State of Victoria during the first month of the current year. The letters A to M given in the first column of the table represent the various subdivisional areas of the State, as described in accompanying list, over each of which the rainfall may be regarded—for general purposes and so far as the data employed admit—as approximately uniform. The significance of the figures in the other columns is fully explained by the respective headings. The method adopted in deducing these results is as follows :—

In each of the fifteen (15) subdivisional regions certain typical rainfall stations have been selected, such that their average record represents approximately the average over the whole of each corresponding region. The total number of these selected stations for the whole State is about 105, from each of which a daily rainfall return is telegraphed to the Observatory. The records from these 105 stations are combined so as to show the rainfall distribution for any period and at any time of the year over each district and over the whole State with sufficiently close approximation to actual conditions to serve the purpose in view.

The proper method of gaining a more accurate notion of rainfall distribution would be, of course, to take into account the rainfall registered at all the existing stations, the number of which is at present 763, but the difficulty of collecting returns and the time required in dealing with them involve delay, and as it is desirable to watch the rain distribution from month to month, and almost from day to day, as the year advances, such information for public current use can be prepared only on the basis of the simpler method above described.

For the complete rainfall tables, such as the one published in the last number of this journal, the whole 763 stations are taken into account, and are grouped, not in areas of uniform rainfall as in the approximate method, but in basins or water-sheds. The reason for this subdivision is that it is more convenient for scientific purposes, especially in connexion with river gauging. Such complete tables will be published in these pages in the future for each quarter of the year, and for the whole year after all returns have been collected and fully reduced.

Rainfall in Victoria.

Month of January, 1902.

Areas.	Actual Average Rainfall recorded in each Area, in January, 1902.	Average Rainfall for each Area for the Month of January, based on all previous years of record.	Maximum Fall recorded within each Area during January, 1902.
	Inches.	Inches.	Inches.
A	0·35	0·74	0·82 at Beulah
B	0·37	0·96	0·49 " Apsley
C	1·04	1·39	1·90 " Panmure
D	1·31	1·57	1·84 " Cobden
E	0·48	0·85	0·79 " Echuca
F	1·30	1·27	2·07 " Benalla
F¹	1·21	1·36	2·50 " Yea
F²	2·21	2·08	2·73 " Yackandandah
G	0·93	1·24	1·35 " Kyneton
H	1·65	1·57	1·98 " Kilmore
I	2·04	1·46	3·07 " Yan Yean
I¹	1·71	1·78	1·92 " Dandenong
K	3·21	2·26	5·97 " Warburton
L	2·81	2·46	3·46 " Rosedale
M	1·03	2·39	1·03 " Gabo

Subdivisional Areas of the State of Victoria, representing typical Distribution of Rainfall.

A. North-west—Mallee country, including the counties of Millewa, Taila, Weeah, and Karkarooc.

B. Central West—Including the counties of Lowan and Borung.

C. Western Districts—Including the counties of Follett, Dundas, western half of Ripon and Hampden.

D. South-western Districts and West Coast—Including the counties of Normanby, Villiers, Heytesbury, and Polwarth.

E. Northern Country.—Including the counties of Tatchera and Gunbower, and the northern half of Kara Kara, Gladstone, and Bendigo, and the north-west portions of Rodney and Moira.

F. Northern Country—Including the greater part of the county of Moira, the north-eastern quarter of the county of Rodney, and the extreme north-west of the county of Bogong.

F¹. Central North—Including the county of Anglesey, the west and northern parts of the county of Delatite, the extreme south of the county of Moira, and the south-east quarter of Rodney.

F². Upper Murray—Districts from Wodonga to Towong.

G. Central Districts North of Dividing Ranges—Including counties of Talbot and Dalhousie, southern half of the counties of Kara Kara, Gladstone, and Bendigo, and the south-west quarter of the county of Rodney.

H. Central Highlands and Ranges from Ararat to Kilmore.

I. South Central Districts on the west and north side of Port Phillip Bay—Including the counties of Grant, Grantville, and Bourke, and the eastern parts of the counties of Hampden and Ripon.

I.¹ South Central Districts east of Port Phillip Bay, &c.—Including the counties of Mornington and Evelyn.

K. Regions of Heaviest Rainfall—including all the mountainous Eastern Districts, and South Gippsland.

L. South-eastern Districts—Gippsland, and counties on the New South Wales Border.

M. Extreme East Coast.

EXPERIMENTS WITH THICK AND THIN SOWING OF GRAIN AT DOOKIE.

By H. Pye, Principal.

I carried out a number of experiments in 1900 in respect to the different rates of seeding of wheat, and some interesting results were obtained. The plots devoted to these tests may be classified as hand sown, or single-seed plots, and machine sown respectively. The single-seed plots were naturally small, being 1–15th of an acre each. The others were larger and varied in extent. The two series of the former plots were planted with the greatest of care, the seed being put in singly at the distance apart determined on for each series. The machine-sown blocks were drilled in with a Farmers Favorite Drill, with coulters 8 inches apart.

A fourth series of experiments, of 1-20th of an acre each, were carried out, in which several seeds were put in holes dibbled certain distances apart. The soil was very uniform, being similar to the red soils of this district. Two of the series of experiments were manured, whilst the third was not.

It will be noticed from the results obtained from the past season that the thicker sowings have the advantage in series A and B, and the medium ones in series D. The results of another series of experiments were nullified by not being harvested before the strong high winds came. It is unfortunate, as they were the intermediate set of experiments between those previously mentioned. When we consider the weight of seed used in the experiments in series A and B, it will be noted that the rate of seed used per acre is, when 1 inch apart—not more than 12 lbs., since the rows were 2 links apart, which distance is rather more than is usual in ordinary practice. This would be considered as thin sowing, but to get the full advantage of this seeding it is necessary that all conditions are perfect, thus :—The soil must be good and thoroughly worked in order to insure perfect germination of the seed, whilst after-cultivation between the drills would be necessary in order to check the weeds. The growing of wheat for practical purposes cannot be profitably carried out by the above method; still I would not be surprised to see at any time in the near future seed drills perfected on lines that I have mentioned some years ago, viz., that will sow the seed in single grains at certain intervals apart, as determined by the farmer ; or, even to sow two or three seeds together at regular intervals. The regulating of the distances between the rows and other adjustments found necessary for the varying sizes of the seed will bring the drill to the highest point of perfection. That there is a good deal of attention being paid to this matter by inventors I have no doubt, as within the last six months I have known two inventors who are working on these lines. It is possible that owing to the wonderful advancement made in

machinery, and the gradual improvements in the methods of cultivation being adopted, that in the future such drills as the above will be in demand. At present the conditions are not yet favorable for their adoption, as the production from the soil is sufficiently great to meet the present conditions of the community; but as soon as a better system of cultivation becomes more general, and the production increases, the necessity of smaller holdings will be apparent. Then competition will be keener, and the farmer as well as others will need to economize, and one tendency to do so will be in the perfection of the modern seed drill. It would not be surprising to find, when nicely adjusting details are more needed, that the services of the electrician will be brought into request, and in respect to the distributing of single seeds of grain there is every reason to believe that, owing to the cheapening of electrical motive power and appliances, an electrical regulating apparatus sufficiently durable and effective to fulfil the conditions practically could be invented if other means failed.

Turning to the tabulated results of experiments on thick and thin sowing of grain in series A and B, there is no doubt but that during last season the advantages lie with the thick sowings, especially in series A, in which the land is not manured.

As the land is improved by the application of fertilizers, as in series B, the difference appears not so marked, for the yield when the seed is placed 1 inch apart is at the rate of 29 bushels 20 lbs. per acre; at 3 inches apart, 29 bushels 31 lbs.; 5 inches apart, 27 bushels 27 lbs.; at 7 inches, 27 bushels 8 lbs.; and at 9 inches apart, 23 bushels 6 lbs. The corresponding yields in series A are:—29 bushels 42 lbs., 28 bushels 4 lbs., 19 bushels 58 lbs., 15 bushels 40 lbs., and 14 bushels 4¾ lbs. respectively. When the grains were sown three at a time, each set of three being 3 inches apart, the yield was at the rate of 25 bushels 34½ lbs. per acre; when each set of three was 5 inches apart the yield improved to 30 bushels 31½ lbs., and descended to 23 bushels 6 lbs. when 9 inches apart.

It will be noted, when considering the experiments carried out by means of the seed drill, that the results are favorable to a seeding of about three-quarters of a bushel per acre. The land was very similar to that on which the other experiments were carried out, but the after-cultivation was not as good, owing to the closeness of the rows; the block was simply horse-hoed. No advantage appears to be gained by giving a seeding of more than 1 bushel of wheat per acre, although in the present instance the seeding of 45 lbs. of grain per acre has a considerable advantage over any other, and in general is sufficient for the conditions here.

I may note that one block of Queen's Jubilee with a seeding of three-quarters of a bushel per acre, gave a yield of 35 bushels per acre; and when the seeding was half-a-bushel, the yield was lowered to 31 bushels 48 lbs. per acre, being a net gain of 2 bushels 57 lbs. in favour of the heavier seeding, after deducting the amount of seed used in each

case. In another experiment with a Steinwedel blooded wheat, sown on the 2nd June by the Massey-Harris seed drill, at the rate of 1 bushel per acre, the coulters being 7 inches apart, the yield was 22 bushels 48 lbs., and when the coulters were 14 inches apart, the yield was 20 bushels 30 lbs. with a seeding of half-a-bushel per acre. This is a gain in favour of a heavier seeding, although the conditions were scarcely parallel in this case, since the distance between the drills differed in either case, though the manuring was the same.

Two plots, one-third of an acre each, of good well-worked fallow land, were sown on 9th June, in order to test the effect of a dressing of ordinary superphosphate at the rate of 150 lbs. per acre, with a seeding, at the rate of a bushel and a bushel and a half respectively, of an Early Purple Straw. The yields were at the rate of 24 bushels 18 lbs. and 28 bushels respectively; or, after deducting the quantity of seed used in either case, there is a balance in favour of the heavier seeding of 2 bushels 12 lbs. per acre.

Another experiment, carried out on 4th May, 1900, with the wheat Ranji, one of Mr. Farrer's crossbreds, gave a yield of 26 bushels 48 lbs. when a seeding at the rate of 1 bushel per acre was applied, and when the seeding was at the rate of half-a-bushel per acre the yield was 25 bushels 30 lbs.; or, after deducting the seed applied per acre, an advantage in favour of the heavier seeding of a little over three-quarters of a bushel per acre was the result.

The number of seeds in an average sample of Purple Straw grown here last season would not vary much from one million and a half to the bushel of 60 lbs., and it would take 31½ lbs. to sow 1 acre, the rows being 1 link (7·9 inches) apart, and the seed 1 inch apart in the rows. The 31½ lbs. of seed sown to the acre does not allow for any seeds that do not germinate, or are destroyed by malting, birds, ill drainage, &c.

Experimental Work, Season 1900.—Thick and Thin Sowing.

Series A, B, and C—Hand Sown.

No.	Name of Variety.	Distance apart of the Seed in the Rows.	Series A. Blocks 1-15th acre.		Series B. Blocks 1-20th acre.		Number of Seeds sown in each Hole.	Series C. Blocks 1-20th acre.	
			Manure.	Rate of Yield.	Manure.	Rate of Yield.		Manure.	Rate of Yield.
				bus. lbs.		bus. lbs.			bus. lbs
1	Nutcut D. Sown from 7th to 13th May.	1 inch	No manure.	29 42	50 lbs. Peruvian guano.	29 20	...	No manure.	Not sown
2		3 inches		28 4		29 31	3		25 34½
3		5 inches		19 58		27 27	3		30 31½
4		7 inches		15 40		27 8	3		28 4
5		9 inches		14 4¾		23 6	3		23 6

SERIES D—SOWN WITH SEED DRILL.

No.	Name of Wheat.	Rate of Seed per acre.	Manure.	Yield per acre.		Nett Yield, after deducting Seed applied.	
		lbs.		bus.	lbs.	bus.	lbs.
1	Steinlee B.	30	75 lbs. Peruvian guano ...	31	43	31	13
2		37½	,, ,, ,, ...	32	32	31	54½
3		45	,, ,, ,, ...	38	0	37	15
4		52½	,, ,, ,, ...	35	54	35	1½
5		52½	No manure	30	57	30	4½
6		60	75 lbs. Peruvian guano ...	34	31	33	31
7		67½	,, ,, ,, ...	33	8	32	0½
8		75	,, ,, ,, ...	36	2	34	47
9		82½	,, ,, ,, ...	34	55	33	33½

No.	Names of Wheats sown with F.F. drill, and manured with Lawes' superphosphate at the rate of 75 lbs. to the acre.	Date seed sown. Rate, ¾ bushel per acre.	Date above ground.	Date in ear.	Date in flower.	Date ripe.	Yield per acre.		Degrees of Rust on flag: 10 maximum.		Degrees of Shedding: 10 maximum.	Remarks about the Straw, &c.
		1900.	1900.	1900.	1900.	1900.	bus.	lbs.		Date. 1900.		
1	Purple Straw, No. 5B	5 May	17 May	18 Oct.	25 Oct.	3 Dec.	36	48	3°	5/11/	1½	Straw strong, purple, very even
2	,, ,, No. 4B	,,	,,	,,	,,	,,	31	6	3°	,,	1¼	,, ,, ,,
3	,, ,, No. 2B	,,	,,	17 Oct.	23 Oct.	1 Dec.	30	12	3°	,,	1½	,, ,, ,,
4	,, ,, No. 1B	,,	,,	,,	,,	29 Nov.	29	15	3°	,,	3	,, ,, ,,
5	Austenlee, 99c ..	,,	,,	22 Sept.	12 Oct.	26 Nov.	37	48	6°	,,	3½	Rust first appeared 17th Nov. P.S. Straw fairly strong
6	Defiance P. S. ..	,,	,,	17 Oct.	25 Oct.	3 Dec.	34	0	1°	,,	3½	Straw strong, purple
7	The Blount ..	,,	,,	,,	,,	,,	34	0	1°	,,	2	,, ,, ,,
8	*Northern Champion*	,,	,,	18 Oct.	,,	5 Dec.	33	6	1°	,,	1½	,, ,, ,,
9	Ranji 99c ..	,,	,,	16 Sept.	2 Oct.	24 Nov.	21	42	5°	,,	3	Weakish straw
10	Sullivan's E. P. 99c ..	,,	,,	3 Oct.	17 Oct.	30 Nov.	33	6	3½°	,,	5	Stands fairly well
11	*Quail*, 99c	,,	,,	17 Oct.	23 Oct.	,,	27	24	1°	,,	1	*Strong straw*
12	51K, 99c	,,	,,	2 Oct.	16 Oct.	26 Nov.	37	45	2°	,,	1	Weak straw, short, purple
13	1 (*J*[1]) 99c	,,	,,	,,	,,	,,	32	6	5°	,,	2	Weak straw, small, thin
14	23e[2], 99c	,,	,,	12 Oct.	17 Oct.	,,	27	24	3°	,,	1	Weak straw
15	Huntly, 99c ..	,,	,,	20 Oct.	26 Oct.	30 Nov.	28	48	3°	,,	1	Weakish straw
16	L. W. L. 99c ..	,,	,,	22 Sept.	12 Oct.	24 Nov.	32	6	6°	,,	..	Rust appeared 17th Nov. Weakish straw
17	Frampton	7 May	18 May	22 Oct.	28 Oct.	3 Dec.	28	18	2°	,,	1	Strong straw
18	Frame's Early ..	,,	,,	18 Oct.	25 Oct.	,,	30	12	6°	,,	3	,, ,,
19	Purple Straw Tuscan	,,	,,	,,	26 Oct.	,,	33	6	6°	,,	1½	,, ,,
20	Velvet Chaff D ..	,,	,,	25 Oct.	31 Oct.	2 Dec.	17	54	8°	,,	1	Short straw. Very rusty and flaggy
21	Budd's Early ..	,,	,,	,,	,,	,,	34	0	3°	,,	0¼	Strong straw
22	Allora Spring D ..	,,	,,	13 Oct.	22 Oct.	26 Nov.	34	30	4°	,,	5	Longer & stronger than No. 23
23	Allora Spring ..	,,	,,	14 Oct.	,,	,,	27	24	5°	,,	6	Fairly strong
24	Nhill	,,	,,	4 Oct.	17 Oct.	28 Nov.	31	12	5°	,,	0½	Straw fairly tall, fair strength
25	Californian Chili ..	,,	,,	,,	,,	6 Dec.	24	24	3°	,,	0¼	Strong
26	Early Baart ..	,,	,,	6 Oct.	,,	26 Nov.	33	30	2°	,,	0¼	Bearded straw, a bit weak
27	Battlefield	,,	,,	19 Oct.	27 Oct.	6 Dec.	34	6	1°	,,	1	Good straw, strong

EXPERIMENTS CARRIED OUT AT THE DOOKIE AGRICULTURAL COLLEGE FARM, SEASON 1900.

Field No. 6.—Durum and Poulard Wheats.

Sown with F.F. Seed-drill, in long plots, from ⅛ acre.

By H. Pye, Principal.

Number of Plot.	Name of Wheat.	Date Sown.	Rate of Seeding.	Manure applied per acre.	Date of Germination.	Nature of Early Growth.	Physical Characteristics of Leaves, &c.	Date in Ear.	Date in Flower.	Date Ripe.	Rate of Yield of Grain per Acre.	Nature of Ear.
		1900.						1900.	1900.	1900.	bus.	
1	Pugh's Rust Resistant	26 April	2½ pecks	100 lbs. Superphosphate (C.S.)	6th May, 1900.	Semi-erect	Greenish, medium length and breadth	22/10/	30/10/	7/12/	30·25	Bearded.
2	Pugh's Rust Resistant	,,	3 pecks	,,		,,	,, ,,	,,	,,	,,	31·25	
3	Mica	,,	,,	,,		Erect ..	Light-green, broadish	18/10/	26/10/	2/12/	33·25	
4	White-eared Mummy	,,	,,	,,		Semi-erect	Green, short, medium breadth	,,	,,	,,	38·6	
5	Missogen ..	,,	,,	,,		Straggling	Green, narrow ..	21/10/	30/10/	6/12/	22·75	
6	Bancroft ..	,,	,,	,,		Erect ..	Light-green, good length	12/10/	20/10/	28/11/	32·25	
7	Hunter's White	,,	,,	,,		,,	Broad flag, healthy green	17/10/	15/10/	30/11/	5·5	
8	Egyptian C* ..	,,	,,	,,		Spindly, very erect	Very light green, broad and long	30/9/	9/10	28/11/	29·5	
9	Florella ..	,,	,,	,,		Semi-erect	Very light green, narrow, fair length	30/10/	8/11/	13/12/	24·25	
10	Atlanti	,,	,,	,,		Erect ..	Light-green, narrow flag, medium length	,,	,,	12/12/	25·75	
11	Atlanti	,,	2½ pecks	,,		,,	,, ,,	,,	,,	,,	25·7	
12	Cretan	,,	3 ,,	,,		Semi-erect	Lightish-green, narrow flag	18/10/	26/10/	30/11/	21	
13	Laidley ..	,,	3½ ,,	,,		Somewhat erect	Light-green ..	21/10/	30/10/	6/12/	35·8	
14	Polish Wheat ..	27 April	,,	,,		Straggling	Narrow long flag, green	21/10/	[illegible]/10/	4/12/	8·9	
15	Egyptian B ..	,,	,,	,,		Very erect, spindly	Very light green, stiff	2/10/	10/10/	22/11/	26·3	
16	Australian Poulard	,,	,,	,,		Semi-erect, somewhat straggling	Narrow, fair length, green	20/10/	29/10/	5/12/	34	
17	Belatourka ..	,,	,,	,,		Semi-erect	Short, narrow, green	22/10/	30/10/	5/12/	22·6	
18	Paros	,,	,,	,,		Erect ..	Lightish-green, broadish, good length	15/10/	22/10/	5/12/	17·9	

EXPERIMENTS CARRIED OUT AT THE DOOKIE AGRICULTURAL COLLEGE, ETC.—*continued.*

Number of Plot.	Name of Wheat.	Date Sown.	Rate of Seeding.	Manure applied per acre.	Date of Germination.	Nature of Early Growth.	Physical Characteristics of Leaves, &c.	Date in Ear.	Date in Flower.	Date Ripe.	Rate of Yield of Grain per Acre.
		1900.						1900.	1900.	1900.	bus.
19	Egyptian A[2] ..	27 April	3 pecks	100 lbs. Superphosphate (C.S.)		Very erect	Very light, stiff, good length and breadth	2/10/	10/10/	16/11/	22·9
20	Banater ..	"	"	"		Semi-erect	Lightish-green, narrow, good length	18/10/	26/10/	2/12/	19·2
21	Mediah ..	"	"	"		Erect ..	Very light green, long, broadish, fairly stiff	13/10/	20/10/	3/12/	24
22	Brown-eared Mummy	"	"	"		Semi-erect	Green, medium width, rather short	17/10/	24/10/	3/12/	15·25
23	Egyptian A[1] ..	"	"	"		Very erect	Good length and breadth, stiff, bright light green	2/10/	10/10/	21/11/	20·5
24	Bearded Club D	"	"	"		Straggly	Narrow, green ..	19/10/	27/10/	3/12/	10·5
25	Salvator ..	"	"	"		Somewhat creeping	Leaves narrow, rather short, green	18/10/	27/10/	"	9·5
26	Egyptian H ..	"	"	"	6th May, 1900	Erect, spindly	Leaves longish, fair breadth, stiff, very light green	7/10/	14/10/	15/11/	14·5
27	Egyptian F ..	"	"	"		Very erect, spindly	" "	2/10/	9/10/	21/11/	12·4
28	Sicilian Baart ..	"	"	"		Semi-erect	Very narrow, medium length, green to light-green	30/10/	8/11/	12/12/	28·2
29	Hebron	"	"	"		"	Short, broad, green	"	"	"	4·6
30	Egyptian D ..	"	"	"		Very erect	Very light green, good length and breadth, stiff	9/10/	18/10/	27/11/	44·1
31	Young's Bearded	"	"	"		Semi-erect to creeping	Fair length and breadth, green	30/10/	9/11/	13/11/	9·85
32	Algerian ..	"	"	"		Semi-erect	" "	"	"	12/11/	10·5
33	Tripola A ..	"	"	"		Semi-erect to creeping	Leaves long, fair breadth, green to light-green	18/10/	16/10/	22/11/	15·8
34	Tripola B ..	"	"	"		"	" "	"	"	"	15·8
35	Tripola C ..	"	"	"		"	" "	17/10/	15/10/	"	21·1
36	Blue Heron ..	"	"	"		Straggling	Narrow, medium length, weak	3/11/	11/11/	20/12/	14
37	Egyptian C[1] ..	"	"	"		Very erect	Longish, good breadth, stiff, very light green	2/10/	11/10/	27/11/	35·3

SEASON 1900.

EXPERIMENTS CARRIED OUT IN No. 5 EXPERIMENTAL FIELD, DOOKIE AGRICULTURAL COLLEGE FARM.

Wheats.

Number of Plot.	Name of Wheat. Blocks, 168 acres each.	Date Sown.	Rate of Seeding per acre.	Manure, and Rate of applying it per acre.	Date of Germination.	Nature of Early Growth.	Nature of Flag or Leaf.	Date in Ear.	Date in Flower.	Date Ripe.	Yield of Seed per acre.	Shed Grain or not.	Weight of Seed per bushel.	Nature of Ear.	Qualities of Seed.	Qualities of Straw.	General Remarks.
1	Ranji A1	1900. 4 May	¾ bus.	45 lbs. dissolved Peruvian guano	..	..	Medium breadth; light colour; paper-like texture; quickly dries.	1900. 16 Sep.	1900. 2 Oct.	1900. 19 Nov.	bus. 30	Shed grain if not cut early.		Rugged and tapering; slightly awned.	Fair size, a little pinched; medium flour.	Slightly laid; a little on the weak side; medium height.	A little rust, 17.10.00, and a fair amount, 5.11.00.
2	,, A2	4 ,,	[illegible] ,,	75 lbs. ,,				15 ,,	2 ,,	19 ,,	31·75						
3	,, B1	4 ,,	[illegible] ,,	No manure ..				16 ,,	2 ,,	21 ,,	29						
4	,, B1	4 ,,	[illegible] ,,	100 lbs. dissolved Peruvian guano				15 ,,	2 ,,	21 ,,	28·4						
5	,, B2	4 ,,	[illegible] ,,	100 lbs. ,,				15 ,,	2 ,,	21 ,,	25·5						
6	,, B2	4 ,,	1 ,,	100 lbs. ,,				15 ,,	2 ,,	21 ,,	26·8						
7	,, B2	4 ,,	[illegible] ,,	100 lbs. ,,				15 ,,	2 ,,	21 ,,	25·5						
8	Tardent's Blue ..	4 ,,	[illegible] ,,	45 lbs. ,,			Fair length & breadth, healthy green	12 Oct.	22 ,,	..	21·9	Shed grain.		Longer tapering; velvet chaff.	Fair size and quality.	Tall; stood well.	A fair amount lost by shedding, especially that manured. A little rust, 5.11.00.
9	,, ,, ..	4 ,,	[illegible] ,,	No manure ..				12 ,,	22 ,,	..	23·5						
10	,, ,, ..	4 ,,	[illegible] ,,	75 lbs. dissolved Peruvian guano				12 ,,	22 ,,	..	23·2						
11	Steinlee B	4 ,,	2 pecks	75 lbs. ,,	15th May, 1900.	Upright.	Fair length and breadth; lightish green.	24 Sep.	12 ,,	23 Nov.	bus. lbs. 31—43	Very little, but stripped before the high winds were severe.		Bold, square, a few short awns.	,,	Purple; 4 feet high; a little lodged.	Faint traces of rust, 17.10.00, fairly pronounced, 5.11.00. No rust on stem of any of these wheats.
12	,, ...	4 ,,	2½ ,,	75 lbs. ,,				24 ,,	12 ,,	23 ,,	32—32						
13	,, ...	4 ,,	3 ,,	75 lbs. ,,				24 ,,	12 ,,	23 ,,	38—						
14	,, ...	4 ,,	3¼ ,,	75 lbs. ,,				24 ,,	12 ,,	23 ,,	35—54						
15	,, ...	4 ,,	3½ ,,	No manure ..				30 ,,	12 ,,	25 ,,	30—57						
16	,, ...	4 ,,	4 ,,	75 lbs. dissolved Peruvian guano				24 ,,	12 ,,	23 ,,	34—31						
17	,, ...	4 ,,	4½ ,,	75 lbs. ,,				24 ,,	12 ,,	23 ,,	33—8						
18	,, ...	4 ,,	5 ,,	75 lbs. ,,				24 ,,	12 ,,	23 ,,	36—2						
19	,, ...	4 ,,	5½ ,,	75 lbs. ,,				24 ,,	12 ,,	23 ,,	34—55						
20	Queen's Jubilee D ..	4 ,,	¾ bus.	45 lbs. Lawes' superphosphate	..	..	Lightish green.	6 Oct.	17 ,,	30 ,,	bus. 35			Bold, square, bald.	Rather pinched; fairly large.	Stood well; whitish.	A little flag rust, 17.10.00, a fair amount, 5.11.00.
21	,, ,, ..	4 ,,	[illegible] ,,	No manure ..				6 ,,	17 ,,	30 ,,	32·7						
22	,, ,, ..	4 ,,	[illegible] ,,	75 lbs. Lawes' superphosphate				6 ,,	17 ,,	30 ,,	38·3						
23	,, ,, ..	4 ,,	[illegible] ,,	45 lbs. ,,				6 ,,	..	..	31·8						
24	Fountlee	5 ,,	[illegible] ,,	45 lbs. ,,			Narrow to medium	22 Sep.	13 Oct.	26 Nov.	31·9	..	..	Square; slight taper.	Fair size & quality.	Purple; 4ft.; stand fairly.	A little flag rust, 5.11.00.
25	,, ...	5 ,,	[illegible] ,,	75 lbs. ,,				22 ,,	..	26 ,,	34·8						

DAIRYING BRANCH.

DAIRY BACTERIOLOGY; OR, GERM LIFE IN RELATION TO OUR DAIRYING INDUSTRY.

A Lecture given to State School Teachers at the Summer School, Training College, Melbourne, January, 1902.

By H. W. Potts.

(*Continued from p. 240.*)

The milk taken from a healthy cow under perfect and cleanly conditions is sterile or free from germ life. During the process of milking, such as we find practised daily in our milking sheds, bacteria, or germs of various species fall into the milk-pail from numerous sources. The organisms in the outer chamber of the teat, on its surface, associated with the dirt and dust on the teats, udder, belly, and flanks, the germ-laden dust wafted up from the floor, the fine particles of manure, the swish of the cow's tail, the unclean bucket, the dirty hands and clothes of the milker, the filthy habit of wet milking, and the invasion of flies, provide the daily supply by which the most delicate article of food becomes contaminated and subjected to fermentative influences. This fluid provides one of the best mediums for the rapid propagation of bacterial life. The most common variety is the species which produce lactic acid, or the fermentative changes evidenced by an increasingly sour or acid taste in the milk. These are known as the lactic acid bacilli. They are single cells, rod-like in form, and so small that it requires about 28,000 to form a line an inch long, or about 400,000,000 to cover a penny postage stamp. To this special variety we are indebted for the desirable flavour and aroma we find in good butter and cheese. When the organisms reach the milk, there all the conditions favorable to their increase are present. They attack the milk sugar in solution, break it down so as to release and secure the oxygen associated with it. By absorbing this and other forms of food a chemical change ensues, and they then throw off their bodies, a waste product, which on examination is found to be lactic acid, carbonic acid gas, and traces of alcohol. As the milk ages the sourness increases. This is due to the enormous multiplication of the organisms, all of which are engaged in effecting the fermentative alteration in the fluid. In the course of time the germs surround themselves with an excess of their waste products, food becomes exhausted, increase ceases, and then we get the change so commonly found in stale milk—curds and whey.

Pure Milk is Sterile.

To demonstrate these facts Pasteur's brilliant successor, Duclaux, had a healthy heifer milked under conditions of complete bacteriological cleanliness into a sterile glass flask. Perfect precautions were taken to exclude organisms and to obtain the milk pure, direct from the udder.

The flask was hermetically sealed and kept for four years. The only change observable was the rising of the oil-fat globules and their coalition to form cream. On breaking the flask the milk was found to be sweet, and unchanged in every particular. Thus, this eminent scientist absolutely proved that fermentation was due to the invasion of germs in milk after it left the cow's udder.

Useful Dairy Organisms.

The lactic acid-producing, or rod-like forms, are useful, if properly controlled, in the manufacture of wholesome and palatable dairy products, but, unfortunately, we are assailed in every stage of manipulation in the cow-shed and dairy with hostile or unfriendly forms of germs—putrefactive organisms.

Antagonistic Germs.

In most instances these reproduce their species by shedding spores or seeds—small spherical bodies. They increase rapidly, and their *waste products, or ferments, create undesirable taints, flavours,* and decomposing conditions. These are antagonistic to good-keeping, well-flavoured butter and cheese. They are always associated with dirt, dust, filth, darkness, and bad smells.

How to Control their Growth.

Pasteur, by means of an elaborate series of experiments, found that the great majority of these organisms, whilst they lived in low temperatures, and even in ice, did not commence to increase until they reached a temperature of about 50 deg. F. From this onward the rate of propagation steadily advanced until body heat is reached, or about 98 deg. F., and at this temperature they arrived at their maximum rate of increase. Beyond this stage a steady decline takes place, and when the temperature of 157 deg. F. is arrived at the majority cease to live. This was formerly known as the scalding point, and for ages it has been an ordinary household custom to scald the milk at this heat to make it keep. Pasteur discovered why, and, in honour of that discovery, this stage or standard of heat is known as the Pasteurising point. We apply this knowledge to everyday life in the dairy, and urge the immediate cooling of milk after it leaves the cow's udder to a temperature as near to 50 deg. F. as it is possible to get, so as to suspend the vitality of the organisms which have got into the milk.

How to Destroy Germs.

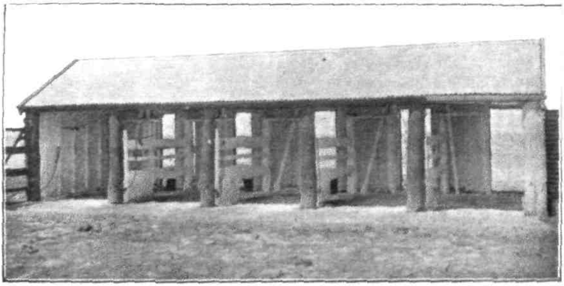
The spores from the putrefactive organisms are, however, found to resist very high temperatures, and hence it is urgent to effect their exclusion that the utmost cleanliness be observed in every operation in the milking shed and dairy.

Steam and boiling water are at all times of the greatest value in destroying organisms which taint the milk. Many spores of taint-producing germs will survive this treatment, and hence it is necessary

to provide other and more effective means of killing them. The most perfect germicide we possess, next to sunlight, is a half per cent. boiling solution of washing soda (1 lb. to 20 gallons of boiling water). All utensils, vessels, cans, &c., in which milk slops or other food material has been brought into contact should be well washed with boiling water and soda, and finally rinsed with water that has been recently boiled. Wherever sunlight can be freely admitted into the milking shed or dairy it ought to be done. It has a most healthy and cleansing effect. Brightly-lighted, well-ventilated sheds and dairies assist largely to preserve the good qualities of aroma, flavour, and condition of butter and cheese.

(To be continued.)

MR. GLEESON'S HOME.



MILKING SHED.

DAIRY INSPECTION IN THE WESTERN DISTRICT.

By R. Crowe.

The work of inspection of dairies, since special prominence has been given to the subject, has made great progress. In no part of the State has more headway been gained than in the Western District.

The Shire of Hampden (embracing the area from which the Camperdown, Glenormiston, Terang, Pomborneit, and other smaller butter factories draw their supplies) made a start five years ago, and was followed by the Heytesbury Shire, in which Cobden and other butter and cheese factories are located: then Colac, in a half-hearted way, a little over twelve months ago. The three local bodies—Warrnambool and Belfast Shires and Koroit Borough—amalgamated, and took the matter in hand in earnest; and now the Colac Shire has taken up the subject thoroughly. The municipalities here mentioned embrace the principal portion of the South-Western District devoted to dairying, and include about one-fifth of the total number of dairy cows in Victoria.

As with the establishment of butter factories, so with dairies, milking-sheds, and conveniences. When the first factories were erected, they were simply copies of buildings used as butter factories in New South Wales; as far as design or suitability was concerned, they might serve equally well for a barn or woolshed as a butter factory. The main part of the building was usually 60 feet long by 20 feet wide, with a 10-ft. lean-to all the way round. The latter served as boiler-room, wash-up-room, storeroom, office, and the balance acted as a verandah. The next factories contained improvements suggested by practice, and now the modern butter factory is very unlike the original, and embodies the essence of the past dozen years' experience.

The same process of evolution is noticeable in connexion with dairy buildings. The first attempts at convenience in the arrangement of yards and buildings were very good, but where the people are in earnest they always go one better when they have the opportunity, and so the process will go on until as near perfection is reached as is practicable.

The Hampden and Heytesbury Shires started very well, and the system adopted by them proved a huge success. The group comprising Warrnambool, Port Fairy, and Koroit municipalities went more thoroughly into the business, and now there is good reason for believing that the Colac Shire is going to eclipse anything yet attempted in the State.

I happened to be in the district when the inspector for the combined municipalities above mentioned sent in his first yearly report, and reference to it will show what can be accomplished in this direction in the space of twelve months:—

"202 new milking-sheds had been erected; 85 milking-sheds had been improved; 395 floors paved or pitched with bluestone pitchers; 63 floors had been paved with bricks; 18 floors with concrete or tar;

38 floors timbered (but he had ordered the removal of timber floors); 24 floors gravelled; 326 yards of milking-sheds had been paved or pitched; 97 piggeries had been removed back from the milking-sheds; 56 new piggeries had been erected, 84 others improved."

All this work has been accomplished within twelve months amongst the dairies situated in the Shire of Warrnambool alone; and the inspector also stated that before sending a report regarding the work done in the Borough of Koroit and Belfast Shire, he had to complete a round of inspection on which he was then busily engaged. This would approximately mean an addition of 50 per cent. to the volume of his work as represented by the figures above mentioned.

A description of the plan adopted by the amalgamation of the municipalities should be of interest to others about to carry out dairy inspection.

A committee comprising representatives of each council were appointed to meet as required to carry out the scheme.

The salary of the inspector was fixed at £250 per annum, and the shire secretary for clerical work £20 a year. The amount is paid in proportion to the number of dairies in each municipality as follows:—

Warrnambool Shire,	with	850 dairies,	contributes	£184
Belfast	,,	250 ,,	,,	57
Koroit borough	..	135 ,,	,,	29
Total	...	...	...	£270

The committee, in appointing an inspector, did not consider it necessary that he should be a veterinary surgeon; it was considered that he should have had experience amongst cattle, and a good knowledge of dairying, buildings, drainage, &c., and be able to impart advice as to the most suitable sites for milking-sheds and piggeries; in fact, to possess generally sufficient knowledge and experience to advise, as well as to carry out, the provisions of the Health Act.

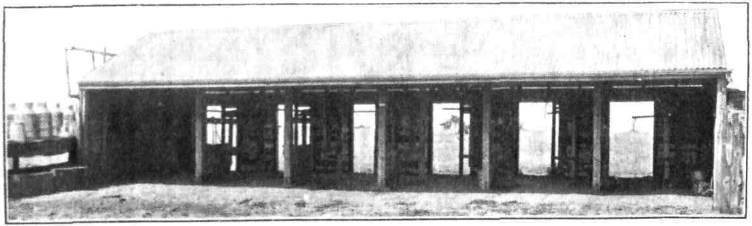
The committee was fortunate in securing the services of a good man in the person of Mr. D. Madden, and an enthusiastic secretary in Mr. H. W. Osborne.

When commencing operations a copy of a plan of milking-shed and piggery was issued free of cost. Dairymen were not bound, however, to adopt the particular design, and it served more as a guide as to the requirements necessary.

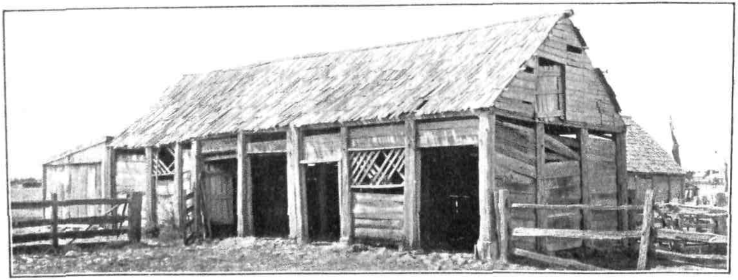
The registration fees levied in order to meet the expenses of inspection were fixed in a sliding scale, as follows:—

For 5 cows and under,	1s.	per annum.
From 6 to 20 cows,	2s. 6d.	,,
,, 21 to 35 ,,	5s.	,,
,, 36 to 50 ,,	7s. 6d.	,,
,, 51 to 75 ,,	10s.	,,
,, 76 and over	12s. 6d.	,,

The inspector ascertains the number of cows in dairy herds for the purpose of fixing the above charges. He devotes the whole of his time to his duties, and makes a thorough inspection of milking-sheds,



Mr. Tate's New Milking Shed.



Mr. Tate's Discarded Milking Shed.

piggeries, the drainage, and the general surroundings of dairies, also the milk vessels, utensils, and conveyances in which milk is sent to factories, creameries, and householders. He also inspects factories and creameries, and serves notices to comply with the Health Act and Regulations, and reports to the committee any neglect. The cattle and grazing ground of same also command his attention.

The amount of capital invested in dairying carried on within the area supervised by this one inspector amounts to no less than one and a half million pounds sterling. The number of cows total over 30,000, and the yearly return secured amounts to about £165,000. It is not too much to expect that the result of the system of supervision practised, and of the efforts by each and every dairyman interested will be to secure a product of higher quality than hitherto. A better and more uniform quality of butter means higher prices, and in fact there is no step that could possibly be taken so calculated to improve the position of the dairying industry in general, and the quality of dairy products, in particular as such a sound method of dairy inspection.

The accompanying illustrations give an idea of the class of milking-sheds now in use. The yards and bails are paved with bluestone pitchers and grouted with cement, permitting the maximum amount of sunlight and ventilation.

HEIFERS: THE BEST BREEDING AGE.

By W. J. Cother, G.M.C.V.S.

This is a question that has exercised the minds of dairymen, and about which there has been some controversy. Some advocate early breeding, whilst others maintain that a heifer should not breed earlier than three years old.

The opponents of early breeding argue that the physical development of the animal is arrested, which is a fact so far as it goes; but it must be remembered that although of great importance, physical development is not the main desideratum in the growth of the dairy cow, the chief end of whose existence is to yield milk, and to attain that object it is necessary that the milk vessels should be developed. This may not be the case if too much importance is attached to the production of large-framed animals.

In discussing this question it must be borne in mind that the dairy cow as we know her to-day is the result of a process of selection and the development of a particular organ, which has reached abnormal proportions.

Milk is a desirable and necessary food for man, and the cow has been selected to supply his requirements.

In a natural state she is only required to yield milk sufficient for the support of her offspring, but man having made a greater demand on milk yielding faculties, she now produces a supply far in excess of a calf's requirements, thus demonstrating that where a demand is made upon natural functions a response will be made to that demand even to a degree that amounts to a condition of disease. It follows, therefore, that in this as in other directions the natural powers must be trained early in the channel in which those powers are to run. In a heifer intended for dairying purposes, this is effected by her early assumption of the maternal functions. On the other hand, if she is not allowed to breed early it will be found that she has developed physically in the direction of producing beef instead of milk.

In a heifer in calf at an early age, when she is in course of development the developing process will be directed to the parts making the greater call on the system, in this case the hind-quarters, for the development of the fœtus, the preparation of those parts for the expulsion of the fœtus, and to the udder for the support of the calf. The development of the hind-quarters will arrest the development of the fore-quarters, and the heifer will be fine in the neck and withers. The reverse is the case of a maiden or barren heifer—she has a tendency to become thick in the withers and neck and inclines to bull-headedness.

The early assumption of the sexual functions stamps the animal with the characteristics of its sex. On the other hand, the deprivation or absence of the sexual functions or organs gives the animal the characteristics of the opposite sex., *e.g.*, the barren heifer becomes masculine, and the emasculated young bull becomes more feminine in appearance.

I think that all the evidence, theoretical and practical, goes to prove that it is desirable that dairy heifers should breed at two years old, the conditions of pastures and climate being favorable. If that is conceded, the question arises which is the most suitable season that heifers should come in? That would vary in different districts. On fair to good summer country, I think autumn the best time, for the reason that the heifer in calf has the advantage of genial weather and good pastures, consequently her condition and growth do not suffer.

The heifer having calved, to make a good cow she should be well fed, and, if her condition holds, milked on for, say, nine months, and should not calve for the second time until fifteen months after the first calving.

Young heifers should be put to a young or very light bull. From the use of large-framed heavy bulls many heifers have been rendered delicate for life, either by being hurt in the service or the calf so large as to render calving difficult.

MOISTURE IN BUTTER.

Last July it was determined by the Minister of Agriculture in London to have a thorough investigation as to the prevalence of fraud in relation to excessive moisture in butter, and to devise means to deal with it by framing and extending regulations under Section 4 of the Sale of Food and Drugs Act for 1899. For this purpose a Departmental Committee was appointed by the Board of Agriculture, consisting of Mr. Horace Plunkett, vice-president of the Board of Agriculture, Ireland (chairman): Professor Sir C. A. Cameron, Dublin; Professor T. E. Thorpe, F.R.S.; Major Craigie, assistant secretary to the Board of Agriculture; Mr. R. J. Anderson, secretary to the Irish Agricultural Organization Society; Mr. Dunn, chairman of trustees, Cork Butter Market; Professor Thomson, president of the Institute of Chemistry; Mr. Kearsey, M.P., and Messrs. George Gibbon and Gilchrist. They were directed to inquire and report "what regulations, if any, may with advantage be made under Section 4 of the Sale of Foods and Drugs Act for determining what deficiency in any of the normal constituents of butter, or what addition of extraneous matter or proportion of water in any sample of butter, shall, for the purposes of the Act, raise a presumption, until the contrary is proved, that the butter is not genuine."

A large number of witnesses were examined, and the conditions of the butter trade in the United Kingdom fully inquired into. A report was presented to Parliament, in which the following recommendations are made:—

"On the question of the actual percentage of water which might be fairly adopted as the limit, the committee took evidence from practical and scientific dairy farmers, agricultural experts, and analysts. It seems that in carefully-made butters the proportion of water ranges from 10 to 15 per cent., but in the case of small producers, with little knowledge, with unsuitable buildings, with rude appliances, and without access to sufficiently cold water in hot weather, there was much more variation. Were the limit to be placed higher than 16 per cent., it is possible that the reputation of, and the demand for, home produce in competition with imported butter must inevitably suffer. No official limit to the proportion of water exists in butter-exporting countries; but it must be remembered that the industry in some of the States is controlled by inspection and branding, or the producers of butter are encouraged to secure a low percentage of water and a uniform standard of excellence by the general dissemination of information and by educational and experimental means. The committee point out that the incorporation or blending of water with butter intended for exportation to this country in order to increase its weight was at one time extensively practised in Hamburg and in certain parts of Holland. A modified form of this practice is now in operation in this country, and considerable quantities of a material known as 'milk-blended butter' are now made by

working milk into butter, whereby the amount of water in the original butter is increased from a relatively small proportion up to 20 or 25 per cent. Finally, the committee recommends the adoption of a limit of 16 per cent. for the proportion of water in butter, to be fixed by a regulation under Section 4 of the *Sale of Food and Drugs Act* 1899, and it makes this recommendation on the assumption that butter containing a larger percentage of water than 16 per cent. will escape the operation of this limit, provided that a sufficient disclosure is made to the purchaser."

THE PRIZE-WINNERS AT THE MILKING CONTEST, KOROIT AGRICULTURAL SOCIETY'S SHOW, 1901.

For several years past the Port Fairy, Koroit, and other societies in the Western District have been conducting a common-sense system of arriving at a cow's first yield of milk at the annual competitions.

The last competition held at Koroit brought out three excellent cows, the photographs of which accompany this article.

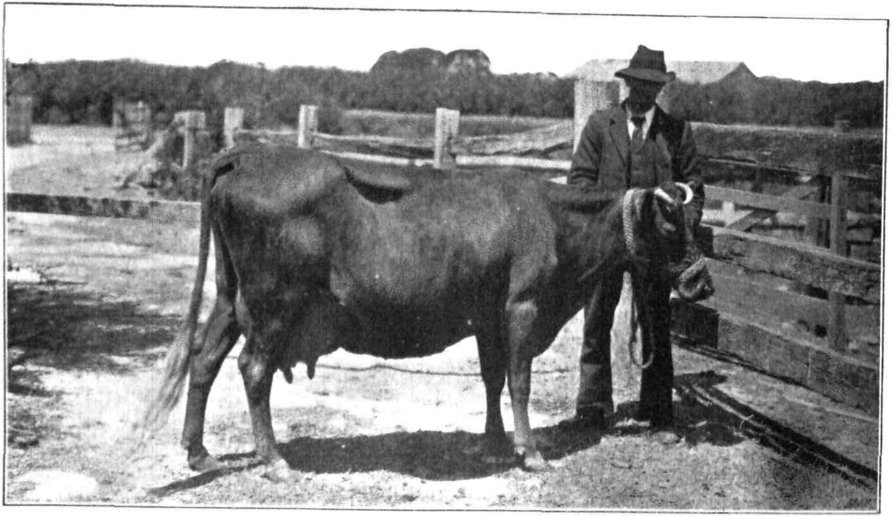
The conditions are that the contest shall take place one week prior to show day. The prizes are awarded to the cows producing the highest quantity of butter in two milkings, to be estimated by the Babcock method. Each competing cow to be milked at her own home under normal conditions, and in such a way as to avoid every chance of the animal realizing that anything unusual occurs. A steward is appointed to see that the animal is stripped twelve hours before the first milking. When being milked for the contest each milking is weighed, and the result recorded on a card. A sample of the milk is taken carefully in strict accordance with a code of directions. When both milkings have been weighed and samples taken and sealed, these are taken to a central place, where the person intrusted with the estimation of the butter-fat has a proper equipment to effect this. The butter-fat contents of each sample is arrived at, and the total yield of butter for the two milkings computed. The records are sealed and produced on show day by the president, who breaks the seal and makes the award on the ground. Each competing cow has to be present, or the owner forfeits £1 previously deposited with the entry.

Every year from fifteen to twenty cows are brought into the competition. The system followed is most popular, and has given the owners complete satisfaction. They are thus assured that the cows have been given fair and just treatment.

At the last show three cows, all cross-breds, ran each other wonderfully close, and the records give unmistakable proof of their capacity as butter producers.

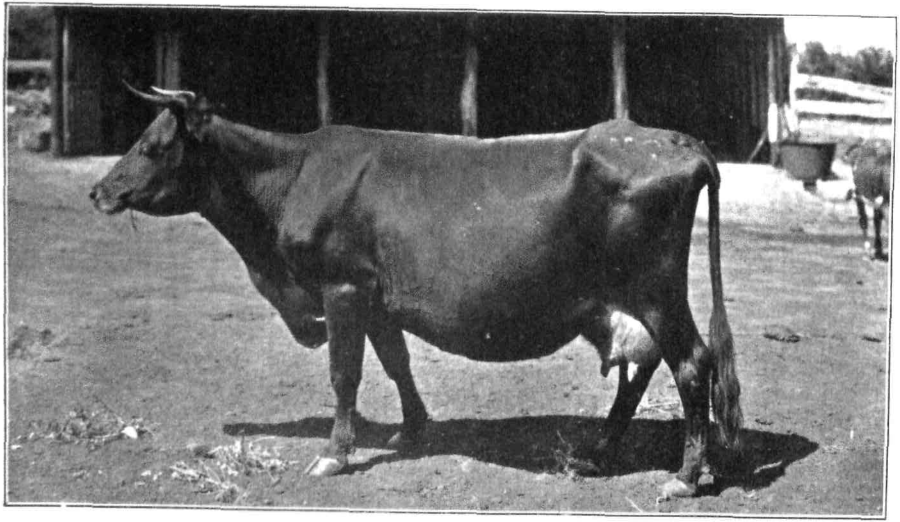
Owner.	Weight of Morning's Milk.	Test Butter-fat.	Pounds of Butter Computed.	Weight of Night's Milk.	Test Butter-fat.	Pounds of Butter Computed.	Total Weight of Milk.	Total Weight of Butter.	Butter.	*Prize.*
	lbs.		lbs.	lbs.			lbs.	lbs.	lbs. oz.	
L. McKinnon ...	37	3·8%	1·554	30	4·4%	1·48	67	3·084	3 0½	First
J. Bauich ...	28½	4·5%	1·425	25 -	5·5%	1·56	53½	2·985	2 15¾	Second
P. McViear ...	43	3·2%	1·558	36½	3·5%	1·397	79½	2·955	2 15¼	Third

Whilst the two first cows are deserving of special attention, and unquestionably stand out prominently as splendid examples of dairymen's ideals from a butter-producing stand-point, we are, however tempted to give prominence to the third cow, for the reason of her

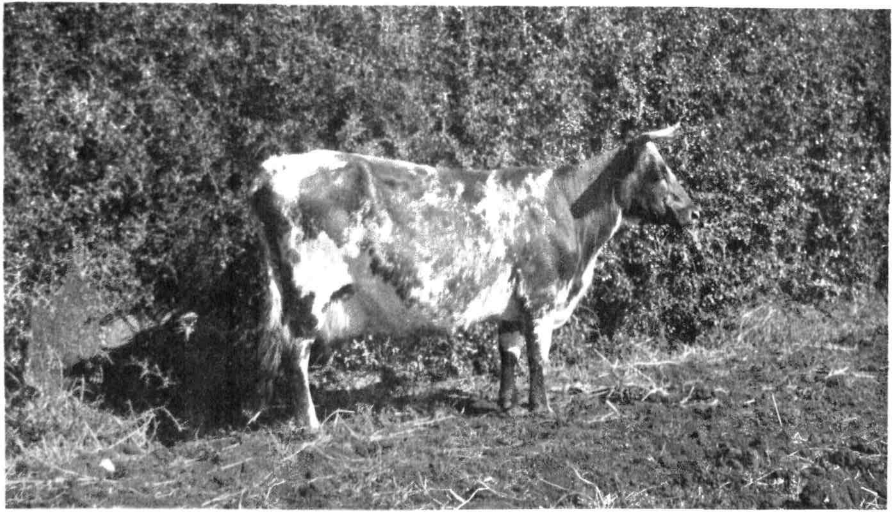


FIRST PRIZE COW.

(Koroit Show.)



SECOND PRIZE COW.
(Koroit Show.)



THIRD PRIZE COW.

(Koroit Show.

marked consistency over a long period. The age of the third cow is ten years. She is a splendid example of that very serviceable cross—so prominent in the Western District—Ayrshire and Shorthorn. With the ordinary pasturage of the district to subsist on, and nothing more than ordinary care bestowed on her, she has, year after year, given splendid yields. For over seven months each season this cow gives five gallons of milk per day, or over a thousand gallons. The following are her butter records at the Koroit contests:—

1898	3·19 lbs. butter
1899	2·905 lbs. ,,
1900	1·967 lbs. ,,
1901	2·955 lbs. ,,

In no instance has she ever been specially fed for show purposes. After the last show her owner, Mr. McVicar, sold her for £50 to go to New South Wales.

VITICULTURAL BRANCH.

FIRST PROGRESS REPORT ON THE VITICULTURAL WORK DURING THE YEAR 1901.

By the Director of the Viticultural Station, Rutherglen.

District Experiment Stations.

The plan of the work of the District Experiment Stations with regard to phylloxera-resistant stocks has been explicitly stated in last year's report, and there has not appeared any reason for a change in that plan. In addition to the stocks carried over from the previous season, cuttings were distributed last August as per tabulated statement herewith. The cuttings being from young vines were naturally of small size. These grew most readily, but had not much capital to draw on if checked by frosts or dry weather, both of which have been experienced since the planting season at all our stations.

It will be noticed that among the names appear synonyms, *e.g.* *Riparia portalis* and *R. gloire; Rupestris phénomène* and *R. du Lot.* These were the names under which they were received from the Government contractor, and it was thought desirable to keep them separate, pending an examination of the foliage and wood.

It is to be regretted that we have not yet received analyses of all the soil samples sent for examination during July–August, 1900, as it is essential for the successful growth of American vines to know the percentage of lime in the soil. Its determination could be easily undertaken by the officers of the Viticultural Branch if the Department would furnish a few calcimetres, which could be imported at very little cost. During the past year the Experimental Station at Dunolly Scent Farm was abandoned. The soil was not altogether suitable, and the rabbits stripped the vines repeatedly.

The planting of all the cuttings was undertaken during August.

Through the public-spirited generosity of the Hon. Hans Irvine, M.L.C., our Station No. 4, at Great Western, is conducted entirely free of cost to the State.

In conclusion, I cannot speak too highly of the unremitting care bestowed on these Experiment Stations by Inspector Adcock, under whose supervision they are placed, and who furnished me with the following tabulated reports. It is also my pleasant duty to record my thanks to the respective honorary managers for their kind assistance. The cultivation of each plot leaves nothing to be desired. By means of these nurseries we are gathering valuable practical data that will be of great service in our national undertaking of reconstituting the vineyards.

No. 2.—MOOROOPNA.

Hon. Manager: Mr. H. Fortin.

Rooted vines from cuttings, season 1900—

Hybrid, No. 3306 ...	810	These are growing luxuriantly, and urgently need trellising.
Hybrid, No. 3309 ...	550	
Rupestris Martin ...	700	
Riparia grand glabre ...	57	

Cuttings from the above—

Hybrid, No. 3306 ...	800	Nursery rows.	60% strike	Manured, watered, mulched.
Hybrid, No. 3309 ...	600		80% ,,	
Rupestris Martin ...	500		60% ,,	
Riparia grand glabre ...	100		80% ,,	

Season 1901: Cuttings from Head Viticultural Station—

Riparia gloire ...	1,000	Planted Nursery rows.	10% strike	Shoots 3 to 4 inches long.	Manured, watered, mulched.
,, portalis ...	1,000		10% ,,		
Rupestris du Lot ...	1,500		5% ,,		
,, phénomène	1,000		15% ,,		
,, Ganzin ...	1,000		5% ,,		
Coudere Hybrid, No. ?	500		10% ,,		
Aramon × Rupestris Ganzin	1,000		5% ,,		

Termites again troublesome this year. The cuttings were planted in part of the plot too soon after treatment with CS_2, to destroy white ants.

The variety Rupestris Martin does not seem to do so well as the others. I noticed this also last year.

No. 3.—BENDIGO.

Hon. Manager: Mr. H. Keck.

Rooted vines from cuttings, season 1900	1,700	These are not making the wood we expected.

Season 1901: Cuttings from Head Viticultural Station—

Riparia portalis ...	1,000	Nursery rows.	30% strike	Shoots 3 ins. long.	Manured, watered, mulched.
Hybrid, No. 3309 ...	1,000		35% ,,		
Rupestris phénomène	1,000		10% ,,		
Rupestris Ganzin ...	1,000		10% ,,		

The cuttings were injured by the frosts, which were rather severe in this district in October.

No. 4.—GREAT WESTERN.

Hon. Manager: Hon. Hans Irvine, M.L.C.

Rooted vines from season 1900	1,100	Many of these have made a remarkably luxuriant growth.

Season 1901: Cuttings from Head Viticultural Station—

Riparia gloire ...	1,000	Nursery rows.	5% strike	Shoots 2-3 ins. long.	No manure, no water, no mulching.
Rupestris du Lot ...	1,000		5% ,,		
,, phénomène ...	1,000		5% ,,		
,, Ganzin ...	1,000		5% ,,		

The soil is kept in perfect condition.

No. 5.—TABILK.

Hon. Manager: Mr. M. d'A. Burney.

Rooted vines from season 1900	300	These are not making very much wood.

Season 1901: Cuttings from Head Viticultural Station—

Riparia portalis ...	500	Nursery rows.	15% strike	Shoots 8 to 18 inches long.	Manured, watered, mulched.
Hybrid, No 3306 ...	500		35% ,,		
Rupestris du Lot ...	2,000		25% ,,		
,, phénomène ...	500		20% ,,		
,, Ganzin ...	500		5% ,,		
Coudere Hybrid No. ?	500		25% ,,		
Aramon × Rupestris Ganzin	500		15% ,,		

The cuttings have surpassed the rooted vines in the quantity of wood produced this season.

No. 6.—ARARAT DISTRICT (WARRA YADIN).

Hon. Manager: Mr. L. Mooney.

Rooted vines from season 1900 ... ... 1,200 } These have not made very vigorous growth.

Season 1901: Cuttings from Head Viticultural Station—

Riparia portalis ...	500	Nursery rows.	25%	strike	Shoots 4 inches long.	Manured, no water, no mulching.
Hybrid, No. 3306 ...	1,000		40%	,,		
Rupestris du Lot ...	1,500		15%	,,		
,, Ganzin ...	400		12%	,,		
Coudere Hybrid No. ?	500		45%	,,		
Aramon × Rupestris Ganzin	100		17%	,,		

The cuttings are healthy and promising.

No. 7.—GEELONG DISTRICT (BATESFORD).

Hon. Manager: Mr. J. Deppeler.

Rooted vines from season 1900 ... ... 1,800 } Growing splendidly.

Season 1901: Cuttings from Head Viticultural Station—

Riparia portalis ...	600	Nursery rows.	50%	strike	Shoots 6 to 16 inches long.	No manure, watered, no mulch.
Hybrid, No. 3306 ...	1,000		50%	,,		
Rupestris du Lot ...	1,000		60%	,,		
,, phénomène ...	400		60%	,,		
,, Ganzin ...	350		80%	,,		
Coudere Hybrid No. ?	500		80%	,,		
Aramon × Rupestris Ganzin	150		80%	,,		

Part of the cuttings are planted near the river. All are making strong healthy growth.

HOW TO PROTECT NEW WINES FROM GERMS CARRIED BY THE AIR.

By R. Dubois, B.Sc.

It has been proved beyond a doubt that many defects are due to foreign germs carried by the dust floating in the air—these germs coming in contact with the wine during the secondary or silent fermentation.

During silent fermentation, wine slowly disengages carbonic acid gas, which fills the space left in the cask, but with a fall in the temperature or a rise in the barometric pressure, the wine and gases shrink, causing a vacuum, and the air rushes in, carrying with it unwholesome germs.

To keep the cask constantly full to prevent the access of air is, therefore, an absolute necessity. As this often becomes a difficult task in a large cellar, several devices have been invented to prevent the air from entering the cask, or to purify it, if allowed to enter.

Figs. 1 and 2 are two bungs provided with valves so arranged as to allow any gas to escape from the cask, but preventing any air from

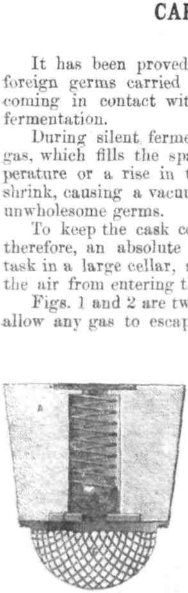


FIG. 1.

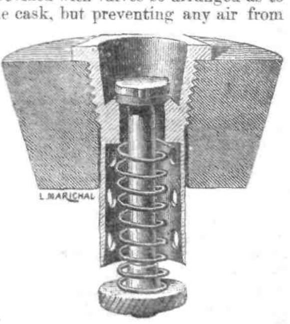


FIG. 2.

entering. The illustrations are plain enough not to require any further explanation.

With the object of purifying the air Algerian vine-growers have for some time used the arrangement shown on Figs. 3 and 4. Two bottles C and D are placed on a plank near the bung-hole; a glass tube A passing through the bung connects the cask with the top of bottle C; a glass siphon B connects the bottom of bottle C with the bottom of bottle D, which is filled with a solution of sulphuric acid. The bung and the cork of bottle C, through which pass the two glass tubes, should fit perfectly, so as not to allow the escapement of any gas. This simple little apparatus of air-purifier acts in the following manner:—When

the disengagement of carbonic acid gas causes the pressure to be greater inside the cask, the sulphuric acid solution is driven back into bottle D, and the apparatus works as shown on Fig. 4. Now, if for some cause or other (fall of temperature or rise of barometric pressure) the pressure becomes greater outside the cask, there is suction through the

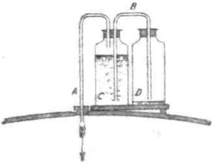


FIG. 3.

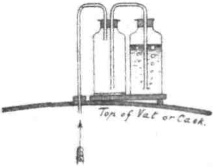


FIG. 4.

tube A, the solution is siphoned into bottle C, and the air is forced to *bubble through the acid solution before reaching the empty space over* the wine (Fig. 3). The air is thus purified of all its germs.

The writer has somewhat modified this arrangement, as shown on Figs. 5 and 6. The whole apparatus is made of glass, and composed of an outer vessel A, into which a neck D is blown at the bottom. This neck passes through a perforated bung. A vertical tube C is blown

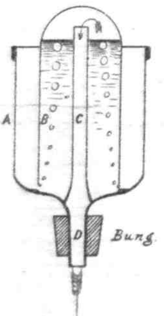


FIG. 5.

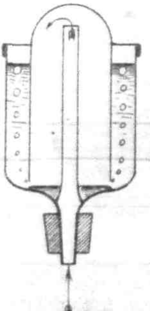


FIG. 6.

inside the bottom of the vessel, and over it is a bell-glass B secured in the position shown on Figs. 5 and 6. If the pressure is lesser inside the cask the solution of sulphuric acid is drawn into the bell B, and the air bubbles through it (Fig. 5). In the other case, when the pressure becomes greater in the cask the air is driven back into the outer vessel (Fig. 6). This little device may easily be secured through the bung of any cask or vat.

CO-OPERATION IN VITICULTURE.

Co-operative Wine-Cellars in Germany.

By R. Dubois, B.Sc.

On the 10th of August, 1899, the small town of Ahrweiler, in Rhinish Prussia, celebrated the foundation of an institution which had for the people of the district more importance than most political events. It was the twenty-fifth anniversary of the first co-operative society of vine-growers, (*Winzervereine*).*

The Government representative who attended these popular rejoicings (the Imperial councillor, Heising) did not consider it derogatory to express personally his good wishes in the humble cottage of F. H. Mies, the first and only president of the Winzerverein of Ahrweiler.

This showed that the Government and public of Prussia understood the importance of the co-operative movement, of which the vine-growers of the Ahr valley were the initiators in European viticulture.

On this occasion we would like to sketch the history and progress of this original application of co-operative principles, as studied during a visit to this fine region, not enough known to the viticultural public, and which has afforded a fine object-lesson to Germany, Austria, Italy, and France.

According to F. C. Huber, co-operation was first given a trial in 1850, in the Moselle, Wurtemberg, and the Duchy of Baden, at the time when Schulze-Delitzsch, the celebrated founder of People's banks, already so widely spread throughout Germany (4,500 were in existence in 1892), endeavoured to promote throughout the rural masses a general movement of economical organization. Although lecturers had publicly taught these principles in the Ahrweiler valley, the first conception of co-operative viticulture seems to be due to a small grower of the district, the sexton of the village, named Kossmann. It was in 1868 that, in this small parish of Ahrweiler, one of these Winzervereine (which are so often met with to-day, grouped two or three together) was definitely established with 50 shareholders.

It is hard necessity—this strong stimulant of energy—which accounts for the sudden awakening of the rural population to the benefits of organization.

For a long time the vine-growers of Ahrweiler had lived a quiet monotonous existence. The Revolution of 1814 had enriched them, as the result of their annexation by France, through the division of the properties of the Chapters and Abbés hitherto their masters. They sold their wine without trouble to consumers and wine-buyers, who visited them to purchase their excellent red wine, the best in all Germany (Walporzheimer).

The climate of Ahrweiler is very severe and rigorous for a plant so delicate as the cépage, exclusively cultivated there (Spatburgunder or Pinots of Bourgogne), and cultivation is very expensive. The traveller

* Winzer + Verein—Vine-growers' Union.

notices it when driving through the narrow valley which the Ahrthal River has cut through the granitic and schistose plain of Eifel, in the cañon, 10 miles long, where the towns of Ahrweiler, Walporzheim, Marienthal, Dernau, Mayschosz, and Altenhar are lying. We are here on the northern geographical limit of vine culture (50° N); spring frosts, summer rain, and autumn frosts are to be feared, and the vines can only grow on the sheltered slopes of the hills. But these slopes are veritable ravines with steep land-slips, where cultivation is only possible by arranging the soil in terraces, which, numbering 20 to 40, are formed like the narrow steps of a gigantic staircase. Here the vine-grower plants his vines, although he has scarcely enough room to stand. Such exceptional conditions require an enormous outlay of money; and it is only by selling the wines at high prices that vignerons could make a living.

With the inauguration of railways, the German markets were flooded with common wines from other parts of Europe, and prices rapidly came down. At the same time a transformation took place in the habits and customs of consumers and of commerce generally. The former, being visited regularly by commercial travellers, ceased to purchase directly from the producer, and wine merchants, widening the scope of their business, began to buy the grapes from vine-growers and make wine themselves, finding a greater advantage in fermenting, handling, and maturing their own wine. The vignerons were at first attracted by this new custom, which gave them the price of their labour directly their grapes were ripe, and relieved them of the burden of making and keeping their wine.

For this reason many of them gave up making wine and building fermenting houses or cellars, and, little by little, lost even the knowledge of vinification. In this state they remained defenceless against the middlemen and dealers in whose hands they were. Year by year the price of grapes became lower, until in years of abundance it was not even sufficient to pay the cost of culture. In 1860 a state of poverty and famine became general throughout the Ahrweiler district. Many small growers were bought out and left the country; some had to go and work in the iron foundries of Westphalia, and others were attracted by the delusive Eldorado of America.

"Weinland arm Land!" wrote Von Groote in 1865, in his statistics of the Ahrweiler district. At Mayschosz the price of a pound of Pinot of the very best quality had fallen to about 18 pfennigs (about 2d.). The remaining wine-growers then resolutely united, and combined to work more economically and to better advantage. They triumphed in the struggle, but not without organization and great sacrifices.

The history of the beginning of the Altenhar Co-operation Society, written by Dr. Wygodzinski, gives an idea of the great efforts required on the part of the vine-growers to struggle against local competition. One day all the credit of the society was suppressed, and the shareholders were asked to pay, within 24 hours, the money advanced by a neighbouring bank. The board of directors

immediately called a general meeting of the shareholders, and requested they would all contribute to make up the amount required. Next morning they all brought sufficient cash to save the society from bankruptcy. The Winzervereine are now out of the hands of banks; they are their own banks, their cellars are luxuriously built with cafés open to the public, and they have immense storing rooms with millions of bottles, and thousands in their reserve funds. They have commercial travellers all through Germany, wine shops in Cologne, Bonn, and other neighbouring towns, and thousands of customers to buy direct from them.

There are now 25 co-operative societies established in the valley of the Ahr (three at Ahrweiler, with respectively 150, 80, and 50 shareholders; two at Dernau and Altenhar, known under the synonyms of Winzervereine and Winbauvereine).

Their shareholders, all very small proprietors, realized that the best means of remaining masters of their own industry, as well as of improving their economic education and technical knowledge, was to place at their head only vine-growers elected amongst themselves. These 25 societies have formed a central federation at Ahrweiler; and it is a small vine-grower, the father of F. H. Mies, who directs and controls millions of capital representing one of the most powerful co-operative agricultural federations in the world.

Co-operation has not only assured prosperity to the peasants of Ahrweiler, but it has also become a school of administration, organization, and economic self-help.

To give an idea of these societies we cannot do better than to describe the Central Society of Mayschosz, which is a type.

According to the regulations of this society, its objects are—"To sell only wines made in its own cellars from grapes supplied by the shareholders themselves, and also to sell the transformed by-products of vinification."

Contrary to what has taken place elsewhere, most of the societies were formed with money advanced exclusively by the supplier shareholders, the capital being usually divided into shares of 50 marks (£2 10s.). Many had to put by their yearly profits, for many years, to pay back the capital borrowed from the banks or others; but many have now become complete proprietors of their cellars and plant. Such is Mayschosz.

These companies are established on the principle of unlimited liability, which develops in the shareholders the sense of responsibility, discipline, and self-help in the interests of all. It is the surest condition of success to viticultural co-operative societies, as well as to People's banks. Each shareholder is responsible, in his own real estate, for the losses sustained by the society; therefore, every one is strongly stimulated to work to avoid them. The great success of these Ahrnthal societies is simply due to this principle of unlimited liability. Another cause of success is the absolute honesty of the commercial operations. They all furnish to the consumer wine of authenticated origin and guaranteed purity and soundness.

"All the shareholders must supply, at vintage time, the whole of their red grapes, non-stemmed." At Mayschosz, the 150 shareholders, representing 288 acres of vines, bring annually about 300 tons of vintage, yielding 35,200 gallons of wine. As the yearly sale of this society is greater, it is obliged to buy 6,600 gallons of wine from neighbours, who, it is hoped, will soon join with the co-operative movement. The price of the grapes is paid to the shareholders at delivery, or by fractions at very short intervals. It is fixed annually by the committee, and is as near as possible to the market value of the grapes. Five per cent. is taken off the price of these grapes, and goes into the *Eventual Reserve Fund*, divided into proportionate shares, of which the shareholders remain titular. This fund is the basis of the profits and losses account, resulting from the sale of wine and by-products. With this object, the amount of the *Eventual Reserve Fund* of each of the shareholders is retained during the last three years. In the case of profit the fund is divided proportionately and paid as bonuses. In case of losses, the money is first taken from this *Eventual Reserve Fund* before asking the shareholders to participate in those losses.

The main practical difficulty is to value the difference in the quality of the grapes. With this object the price fixed annually only applies to Burgundy, exclusive of Portugais bleu, Fruhbergunder, Kleinburger.

The grapes of given varieties are valued according to the richness of their must in sugar (measured with the glucometer of Oechsle) and some years also by their acidity. An average percentage is established for the season; for each degree above it a pfennig is added to the fixed price of each lb. and deducted in the other case. By this means the vine-grower is stimulated, for it is to his interest to carefully work his vineyard, and help the grapes to reach perfect maturity. In other localities where the soils vary, the different sites are taken into account; but everywhere unsound grapes are refused. The wines, made and matured by the society, are then sold in bulk to merchants, by auction at fairs, directly to consumers, or again in cafés or restaurants (Gartenwirtschaft) belonging to the Winzervereine, and established in many large towns. The society has a large stock of wine in reserve, and notwithstanding the difference in yields and qualities, which naturally varies every year, it is always able to furnish the consumer with wines equal in quality and belonging to a certain constant type. The profits are annually divided at a general meeting of the shareholders, and a certain proportion (generally 10 per cent.) is taken from the profits to form the "reserve fund" of the company. This "reserve fund" may be done away with when the society has paid all its debts. Many societies are now utilizing it to buy blocks of vineyards as they come into the market; and if we judge from the number of sign-boards bearing the term "Winzervereine" which, together with those of other proprietors disfigure the beautiful scenery, we see that the co-operative proprietors will soon buy out those that remain outside the co-operative movement.

The administration of the Winzervereine comprises four distinct bodies. The committee, the Board of Verification, the Board of Supervision, and the shareholders generally.

The "Committee," composed of the president, vice-president, secretary, and treasurer, is elected for three years, and is responsible to the society; it manages the business under the direction of the president. The president supervises the staff, the sale of wines, &c., and is paid 1,000 marks (£50) per annum; the secretary receives 1 per cent. of the price of the sales effected. At Mayoschoz, the staff of the cellar is composed of a cellarman, two coopers, and two workmen; but during the wine-making season the society employs 30 men daily. As there is not much work in the field at that time of the year, many of the shareholders are employed, so that co-operation not only benefits in working to the best advantage the produce of the district, but it also helps workmen in obtaining benefits not to be procured in any ordinary factory.

The "Board of Supervision" is composed of three members, elected by the shareholders from amongst themselves, excluding those already on the committee. It controls and supervises the committee, and is empowered to suspend any of its members, pending the decision of the general body of shareholders.

The "Verification committee," composed of three members, together with the president, verify, classify, and value wines.

The "Shareholders" hold two meetings yearly, one in spring and the other in autumn, at which each shareholder, irrespective of the number of shares held, has one vote. At the latter meeting the balance-sheet is submitted and new members elected.

What are the practical results of these associations? They may be summed up in one word—"They have *saved* the vine-growers of Arhthal from ruin, and brought back comfort and prosperity to all the villagers of the district." They have all succeeded; the experience of those first established serving to help the more recent ones. Moreover, to increase their strength these societies have federated, and the president of the Central union, controlling the local committee, has the power of having the wines of each society analyzed to verify their soundness and to suppress fraud and adulteration.

The humble society of Mayschosz has now become one of the richest agricultural federations. It paid for grapes in 1868 sixteen pfennig per lb.; last year it paid 30 to 40 pfennig (5d.). The wine is sold at an average of 1 mark 50 pfennigs per litre (10s. 6d. per gallon); its stock of wine represents a value of £40,000, buildings £10,000, and plant £3,750; finally the vineyards represent a value of £20 per acre.

The number of shareholders in July, 1897, was 126; and in July, 1898, 146, all vinegrowers.

Good example is contagious. The co-operative movement which started in Arhthal has since spread to Germany, the valley of the Rhine, Austria-Hungary, Switzerland, Italy, and is rapidly increasing at the present moment. Its application is extended enough, and its general experience varied and complete enough to allow all viticultural regions, however different may be their local conditions, to find either in Germany or Italy, examples appropriate to their particular wants. Countries where property is small and subdivided, where the yield is

small but the value of the wine great, might follow the example of the valleys of the Ahr and Rhine, in Germany. Countries having a large production of common wines might follow the example of the Po Valley in Italy.

Co-operative Wine-Cellars in Other Parts of the World.

The co-operative wine manufacturing cellars of Europe may be divided into five groups. 1st, the Rhine; 2nd, Germany; 3rd, Switzerland; 4th, Austria-Hungary; and 5th, Italy.

1st. The *Winzervereine* of the *Mittelrhein* (Middle Rhine) are all more or less copies of the Ahrthal type. They spread all along the Middle Rhine; from the vineyard of Sichenbirge at Koenigswinter and Linz up to Bingen, the celebrated bend in the river, in front of which are the famous vineyards of Rheingau. Many of these co-operative societies, like those established in the Moselle valley, are backed by the union of rural banks of Raffeisen and Neuwied.

. In *Suddentschland* (South Germany) these societies, more varied in form, are met with in Wurtemberg, Weinsberg, Unterturkheim, Beilstein, &c. The most successful is that of Heilbronn, created with the material and moral help of the municipality; it has established auction sales, where wine is sold per hogshead, and which are now frequented by all the hotel-keepers of the region. The movement of co-operative association has recently extended to the Duchy of Baden, on the shores of Lake Constance. In Bavaria and Alsace, six co-operative cellars have been recently established in the most renowned crus of Ribeauville, Wolxheim, Eguisheim, Guebwiller, &c. On the 1st of January, 1899, an institution of a new type was opened at Colmar—the "Bourse aux Vins" (wine market). It was founded by 150 of the principal vine-growers of Alsace, with the object of making the public directly acquainted with the excellent natural wines of Alsace, and of fighting against the increasing sophistication encouraged by the law of 1892 allowing the addition of sugar to the vat. A board of wine-tasters examines the wine put up for sale, and that which is accepted is sold by the "Bourse" under its guarantee and stamp. The wine is sold by public auction or by agreement, the best samples being retailed to one of the finest and most important cafés of Colmar, which is connected with the Bourse.

In Switzerland œnological societies have been established since 1872 in the Valley of the Rhine, at Sion, St. Maurice, Vetro, Granges-Lens, &c. They generally sell their wine in bulk, and often even their must. According to Rocquigny, "with the object of dividing the profits amongst the shareholders, a normal price is fixed for grapes; one

that can be eventually increased by a bonus paid on three co-efficients; situation of the vineyard, mode of cultivation, and the weight of must in saccharine matter. It is said that the œnological societies of the Valleys give to their shareholders a profit of 25 to 30 per cent. above the price obtained by vine-growers remaining outside the society."

4th. In Austria-Hungry there are established under the name of Kellereigen two groups of societies resembling those of Ahr. One in the region of Siebenborgen (Transylvania), which seems to have spread in Russian Bessarabia; the other in the Tyrol, where, since 1892 (thanks to the active propaganda of Dr. Mach, the learned œnologist and director of the Agricultural Institute of San-Michele) over ten societies have been established; in Neumarkt, Andrian, Terlan, Auer, &c. Following their example, Bargo, Riva, Rego, in Italy have established co-operative cellars. Like those of Germany they are backed up by the People's banks, whose auditors inspect their accounts. As in Italy, they have the moral support of the Government.

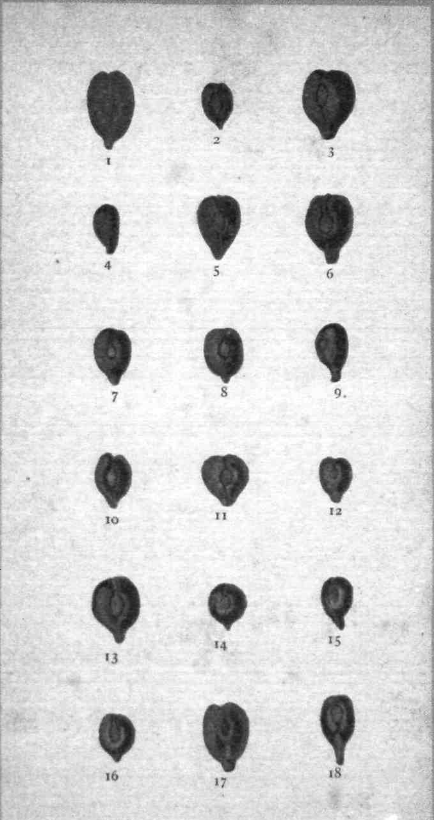
5th. In Italy the "Cantine sociale" are of two types; some purely co-operative, that is to say, composed of "supplier shareholders" only, and which work solely in the interests of the vine-growers who supply them with grapes; others are composed of supplier shareholders and others who supply the capital. The oldest is that of Sondrio, established in 1872, with a capital of £16,000, divided into £[illegible] shares, in order to take the local wine-growers out of the hands of the Swiss wine merchants, who were the only buyers of wine in that region; but it was only after the cessation of commercial relations between France and Italy in 1882, that the co-operative movement spread all over the Peninsula. It was only then that the Italian Government, by a series of competitions, where upwards of £1,000 was distributed in prizes, and by the active propaganda of its best professors, such as Cavazzi, endeavoured to establish co-operative societies all through Italy. Their object was to make a wine of a constant type and of high qualities which was to be sold, either to wine merchants in Italy, or exported direct to Germany and Austria. Among the societies we may mention the *Societa œr logica valtellines* of Sondrio, the *Cantine sociale Pestelinni* of Bagno, the *Unione viticola* of Brindisi, the *Societa viticola* of Verona, the *Union œnologica di Ripatransone* of Ascoli, which treats over 1,000,000 gallons a year, and the *Cantine sociali d'Oleggio*, of Porto Ferrago, of Stra, Barbaresco, &c.

In France the title "co-operative" has been used by producers and merchants on the South and Bordeaux region, but rural co-operative societies are very rare. They do not seem to have succeeded as well as

those in other European countries. Up to the present we only know of one society which deserves to be called "co-operative"; it is that of Damery, which actually sells 100,000 bottles of champagne per annum. This was the result of a vast scheme of a socialistic character, which a very young man (R. Lamarre) attempted to create in 1890, in order to form a coalition of 25,000 vine-growers of champagne against the other large manufacturers of sparkling wine.

To sum up, the co-operative societies actually in existence, and which are working successfully in Europe, number about 100 in the German countries, and 50 in the Latin.

We do not under-estimate the difficulties attending the creation of such societies in the vine-growing regions of Australia; but as even greater obstacles have been surmounted in Europe, and as a successful start seems to have been made by the Mooroopna Winery Company in our own State, it is to be hoped that circumstances similar to those which induced the wine-growers of Ahr to unite and co-operate will take place here, that amongst our wine-growers some one will follow the example of Kossmann, Josten, and Mies. May the experience of foreign countries serve as a guide, and the new difficulties arising from the extended discovery of phylloxera, and the present state of the wine market, be overcome by a practical and sound application of co-operative principles to minimize individual expense, and assist the annual production of large quantities of sound wines of constant and uniform types.



VINE SEEDS.

1.—V. Rotundifolia. 2.—V. Munsoniana. 3.—V. Candicans. 4.—V. Coriacea.
5.—V. Linsecumii. 6.—V. Æstivalis. 7.—V. Bicolor. 8.—V. Monticola.
9.—V. Rupestris. 10.—V. Arizonica. 11.—V. Rubra. 12.—V. Riparia.
13.—V. Cordifolia. 14.—V. Berlandieri. 15.—V. Cinerea. 16.—V. Californica.
17.—V. Labrusca. 18.—V. Vinifera.

VINE SEEDS.

THE RECOGNITION OF SPECIES.

By R. Dubois, B.Sc.

One of the botanical features of the grape-vine is found in its seeds. A given variety may have its bunches large or small, loose or compact, more or less shouldered, according to the nature of the soil in which it is grown, the climate, position, elevation, &c. Its berries may also be affected in the same way, and differ in colour, consistency, or size; they may contain few or more seeds (normally never more than four); but the seeds, though to some extent variable (especially on account of their number and mutual pressure where more than one are present) exhibit some constant reliable features.

A single seed is always thicker, plumper, more rounded; two seeds are flattened on the inner and rounded on the outer side; three or four seeds are more slender and angular, and form a triangular section when looked at from the top. These variations may often be found in the berries of the same bunch. They do not affect the peculiar seed features of each species.

The big top (see Figs. 1 and 2) is convex or rounded, or is more or less deeply notched.

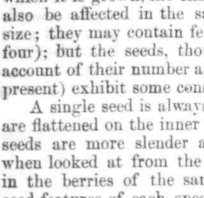


FIG. 1.—INNER SIDE.

The thin lower end, short and abrupt, or more or less elongated, is called the *beak*. On the inner or ventral side (Fig. 1) are two shallow longitudinal irregular depressions; between them is a ridge, slight where there are one or two seeds, sharp where there are three or four pressed together. Along this ridge is the *raphe*, a kind of slender thread running from the *hilum* on the beak, over the top of the seed, and ending on its outer side in an elongated, oval, or circular well-marked spot, called by botanists *chalaze* or *chalaza* (Fig. 2). This thread may be entirely indistinct on the outer side and top, or it may be slightly perceptible or more or less prominent like a cord.

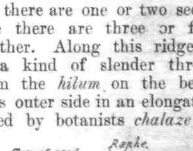


FIG. 2.—OUTER SIDE.

These different characters seem very reliable in American species, but with the varieties of *Vitis Vinifera* (grape-vines of the old world) many thousands of years removed from their original stock, the form of the seed seems to undergo important modifications, and can no longer serve as a safe guide for the discrimination of the varieties now cultivated. But different as they are, they all have a

character in common, distinguishing them from American and Asiatic species—their *beak* is narrower and very much longer, their *chalaze* is large, and always occupies the upper half of the seed.

Seeds of American species, on the other hand, have a much shorter *beak*, and a *chalaze* usually smaller and narrower, and always placed in the centre of the outer side, which would tend to prove their common origin. Any one who wished to satisfy himself of this, the most constant character, need only compare the pips of an ordinary grape-vine with those of the American vine on Plate II. This photograph, taken at the Viticultural Station last month, shows the seeds of four different vines enlarged five times (5 diametres). The Carignane, Red Prince, and Black Prince are all *Vitis Vinifera*. This may be seen at a glance from the length of their *beak* and the position of their *chalaze*. The Taylor is a cross between *Vitis Riparia* and *Vitis Labrusca*. It has therefore no European strain whatever, and exhibits the seed features of both those American species, as may be seen here. In short, seeds may serve to distinguish one species from another, but not one variety from another.

The size and weight of seeds also vary greatly from one species to another. For instance, *Vitis Labrusca* and *Vitis Candicans* have the largest seeds, *Vitis Cinerea* and *Vitis Riparia* the smallest. However, even in the wild species we find variations, but it is in varieties of *Vitis Vinifera* that variations are most marked.

Here is, according to Foëx*, the number of seeds contained in 1 lb. weight of some of the best known kinds used for reconstitution :—

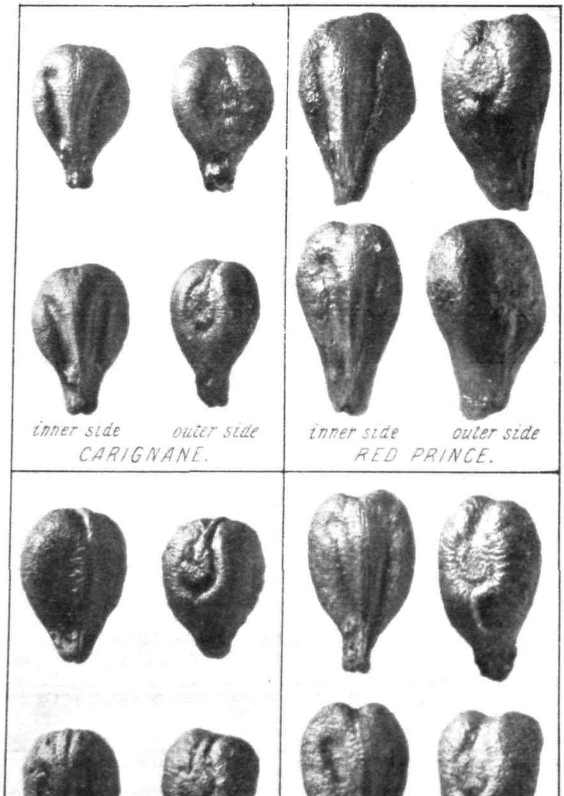
Jacquez	about	15,545	per lb.
Herbemont	,,	18,590	,,
Cunningham	,,	14,635	,,
Vitis Riparia (wild)	,,	25,820	,,
Solonis	,,	8,295	,,
Taylor	,,	15,810	,,
Vitis Californica	,,	8,910	,,
Vitis Berlandieri	,,	12,000	,,

Some authorities have laid stress on the colour, which varies between reddish-brown and light yellow or light green, but this character does not seem quite so reliable as the shape. The coloured plate accompanying this illustrates the different characters above mentioned. The figures are magnified twice (2 diametres), and they all represent the outer side of the seeds. This plate is extracted from Pierre Viala's work *Une Mission Viticole en Amerique*, 1889.

Here are, according to the same author, the botanical features of the seeds of the most important species :—

Fig. 1.—*Vitis Rotundifolia*.—Two or three in number, large, elongated (length 9 mm., width 5 mm.), uniform in shape, flattened, often asymetric, dark-brown chocolate, with brick-red hue on the depressions of the inner face ; *beak* narrow and short ; *raphe* not

* G. Foëx. *Manuel Pratique de Viticulture*, 1899.



VINE SEEDS, MAGNIFIED FIVE TIMES.

visible; *chalaze* rudimental, in its place is an oval shallow depression, from which well-marked grooves radiate. This is the only species with such radiating grooves.

FIG. 2.—*Vitis Munsoniana.*—Small (length 5 mm., width 3 mm.), even in shape, shining grey chocolate colour. *Beak* small, tapering to a point; *chalazic depression* shallow; *chalaze* oval, longer than wide, exactly in the centre of the seed, and surrounded by a narrow groove from which radiates numerous fine striations; *raphe* not visible, in place of it, a depression running to the end of the beak on the outer and inner faces.

FIG. 3.—*V. Candicans.*—Generally two or three in number, very large (length 7 to 8 mm., width 5 mm.), notched, asymetric, reddish-brown, shining on the outer side; *beak* broad and short; *chalaze* and *raphe* rudimental, and placed on the bottom of a depression almost reaching the beak on the outer side. Few striations around the chalaze not distinctly marked.

FIG. 4.—*V. Coriacea.*—Small or medium (4 mm. by 3 mm.), cross section triangular, shining brown on the outer side, with well-marked depressions yellowish-brown in colour; *beak* short and narrow, well detached; *chalaze* oval, well marked, continued by a *raphe* disappearing in the notch. A slightly marked groove runs from the chalaze to the beak on the outer side.

FIG. 5.—*V. Lincecumii.*—Three to four in number, some abnormal berries are found with five seeds. Large (7 mm. by 4 mm.), pear-shaped, shining chocolate colour, wide shallow depressions lighter in colour; *beak* short, well marked; *chalaze* wide, rounded, irregular in shape, only slightly protruding; *raphe* independent from the chalaze, forming a cord reaching the slightly-notched top of the seed.

FIG. 6.—*V. Æstivalis.*—Two or three in number, rather large (7 mm. by 5 mm.), cylindrical, brown, slightly shining, lighter in colour on the chalaze, raphe, and beak; *depressions* slightly marked; beak broad and thick; *chalaze* more or less circular, strongly developed; *raphe* cord-like, running over the top of the seed to the beak on the inner side.

FIG. 7.—*V. Bicolor.*—One to three in number, medium size (3 mm. by 5 mm.), stout, ashy-brown colour, ground surface; *depressions* well marked; *beak* short, but well detached; *chalaze* oval and rounded towards the beak, slight and tapering towards the thread-like *raphe*, which runs over the top, along the inner side, and down to the hilum.

FIG. 8.—*V. Monticola.*—Two or three in number, rounded and thick, medium (5 mm. by 4 mm.), reddish-brown, shining, slightly notched. *Depressions* deep, well marked; *beak* blunt and broad; *raphe* forming a thin salient cord running from the chalaze to the hilum on the inner side; *chalaze* well developed, placed in a shallow, long, and narrow dent. The union of the raphe to the chalaze resembles that of V. Riparia, but the general appearance is more like that of V. Æstivalis. Slight radiating striations may be seen on some seeds.

FIG. 9.—*V. Rupestris.*—From one to four, small or medium, (4 mm. by 3 mm.), light mahogany colour. The top of the seed is obtuse and not notched. *Depressions* well marked towards the base of the beak, and shining; *chalaze* narrow and long, placed in a shallow depression with rudimental radiating striations, continued towards the beak by a narrow groove, and towards the top by a deeper groove in which is the very inconspicuous *raphe.*

FIG. 10.—*V. Arizonica.*—Two to three, rather small (5 mm. by 2½ mm.), stout, dull, dark brick-red, more shining on the *depressions,* which are indistinct; *beak* stout, short; *chalaze* oval, flat, tapering towards the filiform *raphe* completely disappearing in the notch.

FIG. 11.—*V. Rubra.*—Generally two in number, large and almost spherical (7 mm. by 5 mm.), brown-red, shining, slightly rugose; *depressions* wide, deep, waved, yellow, shining; *beak* very short, indistinct. *Chalazic depression* very deep, well notched; slight radiating striations round the chalaze. *Chalaze* oval, protruding irregularly; *raphe* invisible.

FIG. 12.—*V. Riparia.*—Generally two in number, medium (6 mm. by 5 mm.), brown-red, shining, slightly rugose. *Depressions* wide and deep, waved, yellow, shining; *beak* very short, almost unapparent, *chalazic depression* very deep, continuing down to the beak, running over the top, which is depressed; *chalaze* oval, irregularly protruding; *raphe* invisible.

FIG. 13.—*V. Cordifolia.*—Two to three in number, medium (5 mm. by 3 mm.), stout, resembling in shape the *V. Æsticalis* and *V. Cinerea,* vinous-red or brown-grey, shining; *depressions* well marked, rather more yellow towards the beak; *beak* short, stout; *chalaze* round, prominent, in a well-marked depression; *raphe* detached from the chalaze, thin, cord-like, much lighter in colour, runs over the top of the seed and ends in the middle of the inner side. The chalazic depression is continued towards the beak by a small shallow groove.

FIG. 14.—*V. Berlandieri.*—Two or three in number, medium or small (4 to 6 mm. by 3 mm.), occupying almost the whole of the inside of the berry, stout, colour varying from brown-yellow to deep-red ochre. *Depressions* lighter in colour, shallow; *beak* short, pointed, well detached; *chalaze* round, slightly developed, but well marked, tapering to a point where it joins the *raphe,* which is slightly apparent, runs over the top of the seed, and ends in the middle of the inner side. At the base of the chalaze is a slight groove running towards the beak. A few striations are occasionally seen round the chalaze.

FIG. 15.—*V. Cinerea.*—Generally one only, medium or small (4 mm. by 2½ mm.), cylindrical and long, chestnut colour, dull, with slightly marked *depressions; beak* narrow and short, well detached, (independent); *chalaze* small, round, in a shallow depression, with few radiating striations; *raphe* filiform, well apparent, disappearing in the notch.

FIG. 16.—*V. Californica.*—Often one only, small (4 mm. by 3 mm.), stout, colour of dead leaves with reddish sheen, dull and rugose surface: *beak* short and blunt; *depressions* rather deep and narrow; *chalaze* oval or triangular, suddenly stoped at the *raphe*, which is completely missing; in its place is a narrow groove running to the notch.

FIG. 17.—*V. Labrusca.*—Two or three in each berry, large (8 mm. by 5 mm.), stout, resembling somewhat those of *V. Candicans*, deep chocolate colour, smooth and shining, light yellow on the depressions and around the chalaze; *beak* short, rather narrow; *chalaze* generally depressed; no *raphe* visible in the groove which extends from the chalaze to the notch.

FIG. 18.—*V. Vinifera.*—This species, including all the wine and table grapes, differs from all the above species by its *beak*, which is much longer, and its chalaze, which is always placed in the upper half of the seed instead of the centre. Specimens of seeds out of a lot of raisins found with an Egyptian mummy, and probably now 3,000 years old, or older, are preserved in the Egyptian Museum of Berlin. They show that seeds of *V. Vinifera* have undergone only very slight modifications during such long ages.

SEASONABLE WORK IN THE CELLAR AND VINEYARD.

By R. Dubois, B.Sc.

APRIL.

CELLAR.

Most of your time will be devoted this month to the work of the fermenting-house and cellar.

Where the vintage is not over, watch carefully the fermentation. It is more than ever necessary to keep down the temperature in the vat, the must being richer in sugar than at the beginning of the vintage. If a vat *sticks*, rack it in another vat and aerate.

Marc should not be thrown away. It may either be ensilaged, and thus form a good food for pigs, fowls, or other animals, or it can be made into piquettes, which are later on distilled.

New Wines.—Never place them near old wines, for they will cause the latter to ferment. Do not bung casks containing new wines, but place lightly over the bung-hole a plug or a small bag filled with clean sand. These little bags must be kept scrupulously clean—"One keep-clean is better than ten make-cleans." Casks containing new wines must be frequently filled up, especially where the vintage season has been hot and dry. Filling must be done every other day for the first fortnight, then twice a week, and once a week when the secondary or silent fermentation is completed. A cellar where casks are allowed to remain ullaged soon becomes a vinegar-yard. If you have a cask left over which is not quite full, drop through the bung-hole some well-washed stones, quartz, or granite, but not limestone or chalk) until the wine is level with the bung-hole. Do not fill up with water—the Wine Adulteration Act forbids it. Do not burn sulphur in the cask, or you will stop the silent healthy fermentation, and prevent your wine from becoming completely dry. For the same reason, never place new wine in a very cold cellar, as this would check silent fermentation.

Old Wines.—Towards the end of the month proceed with the third normal racking of last year's wines, and place them in hogsheads bung sideways. Old maturing wines should be racked as soon as the cold weather sets in, and placed bung sideways. Rack, fine, and rack again those ready for bottling. Select for every one of these operations a fine, bright, still day, and work during the cool hours of the morning rather than during the afternoon, when it is warm.

VINEYARD.

The vintage is still in progress in the cooler districts. The winged form of the phylloxera will be swarming during the month. A few sexed insects may still be found towards the end of the month, when multiplication ceases. In the northern vineyards the bunches still on the plants are quickly drying up, and as they have lost a part of their water by evaporation, will furnish a must which in many cases will not ferment dry.

HORTICULTURAL BRANCH.

SCHOOL OF HORTICULTURE, BURNLEY.

C. Bogue Luffmann.

CONTENTS FOR APRIL.

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II. Pruning competitions: aids to the work and judging.
III. The bulk manures of Victoria.
IV. The orchard.
V. Table and drying grapes.
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VII. The hardy flower garden.
VIII. Diseases in the orchard (A. G. Campbell).

Autumn and Winter Treatment of Orchard Lands.

The neglect to cultivate in autumn and winter is productive of an enormous number of weakly and unprofitable trees; and, further, where work is carried out at regular seasons the results are liable to be equally unsatisfactory, as the soil temperature, age, condition, and requirement of the trees varies greatly in different years.

Cultivating in the cool seasons of the year is done with the object of keeping the temperature of the soil up to a pitch which will enable the roots to grow; and this they can do only where air and a fair amount of moisture combined with plant food is readily available. Sour, cold, and airless soil admits of no healthy root growth, hence cultivating is necessary wherever sharp contrasts exist between the summer and winter temperature.

Autumn soils are usually too dry to admit of roots starting early and growing over a long period, hence it is usually necessary to get to work in March or April in order to attract moisture at a season when there is heat enough in the soil to stimulate root growth. Regular head growth and cropping can result, only when a steady root extension takes place in the fall and winter months, hence it becomes necessary to see that every facility exists for this movement. If roots do not grow in autumn or winter the feeding power must be extremely limited in the following summer. Naturally the greater the root growth the stronger the head must be in the following season.

The roots of ordinary fruit trees cannot "rest" without danger, under local conditions. They either go forward or backward, and they are frequently "starved" in autumn and winter through the dry, hard, and airless condition of the soil at one season, and the excess of cold, water, sourness, and stagnation which is allowed to pervade them at the other. Winter work is, therefore, a means of helping out the draining, aerating, and warming of soil. Autumn cultivating attracts as much moisture as will keep the soil active; winter cultivating reduces the water, and thereby increases the

temperature of the soil, and so maintains its activity. In general practice, too little moisture obtains in autumn, and too much in winter, so that at neither season is there a perfect root growth. By starving in autumn, trees stop growing, crop over much, and quickly decline, whilst anything like over-feeding leads to coarse wood growth, only a small proportion of which can easily be induced to bear fruit.

Young trees, and such as are declining through over-cropping, poorness of the soil, or the rigours of climate, are most in need of skilful cultivating in autumn and winter. A young tree has but one function to perform—that of making robust wood—and it should be encouraged to do this over as long a period of each year as possible. If it does not grow at the roots from early autumn well into the winter, it will become hard in the bark and make but a small and weakly set of branches. The soil of young orchards should be so prepared that the moment the leaves fall in autumn the roots should become active and start out into a further breadth of new and acceptable soil. With all mature, but weakly trees, the same opportunities should be provided. It is only where young trees are large and strong enough to bear fruit, and show little or no inclination to do so, that the soil may, with advantage, be kept close and somewhat dry in autumn, though it should never be entirely airless, or in any way sour. This mild starving has the effect of reducing the activity of the sap so that it eventually makes weak head growth of a fruitful character. Trees in full bearing must be encouraged to make a steady root growth. If strong it will throw them out of bearing; if very feeble they will make an excess of flower buds, and then none at all till more sustenance is forthcoming. Trees of different species and ages require to be examined in detail before one can decide exactly what treatment they need. The roots of trees vary in size, shape, character, and length of life according to the nature of the soil which sustains them. Strong roots form only in close, firm, or heavy soils, therefore it is unwise to preserve a loose, puffy mass about young trees, which desire to make none but strong foundations during the first few years of their lives. In practice it is necessary to have the soil much looser in summer than in autumn or winter, in order to avoid excessive heat and dryness. So long as trees desire to make a free root extension the soil should be comparatively firm at their root tips, and the surface soil should be but lightly cultivated as a means to aerate and moisten the mass. When growing roots are torn or receive much air they divide their strength between innumerable rootlets and fibres, none of which have the power of doing much good or lasting work for young trees. When the flush and rush of youth is past, the main roots, lying in the soil like the spokes from the hub of a wheel, begin to furnish their sides with lighter roots, and these in turn supply multitudes of feeding points; so that when a tree is grown up, heavy feeding is done well within its drip, until such time as all the soil mass has been run through by the roots, or the action of rain and cultivating has worked out all the food stuffs. Here we see how, when

and where to cultivate for the production of roots alone, but as all the superstructure and value of the trees depends entirely on the nature and behaviour of these, it follows that the two most important subjects of study for the fruit-grower are the soil and the behaviour of roots therein.

As soils vary in their consistency, water, and heat-retaining powers, so do they call for different treatment, always remembering the nature and demands of the trees. Normally, the more water soil holds in winter, the colder, more sour, and objectionable it must prove. In practice, a gallon of water passing through soil does not injure as much as a tablespoonful lying on its surface or at its base.

Stagnant water is the curse of the orchard, no matter what the season, soil, age, or kind of tree. Autumn and winter cultivating provide enough water to dissolve, and make available, food elements for the roots, but no more. As fires go out for the want of air, so movement of all kinds stops when water is shut in and air excluded from soil.

Stiff soils, even when rich, lock up their food elements more completely than do loose, sandy, humic, or in any way open soils: so that it becomes necessary to work them often in order to decompose and recompose the requisite food. Stiff soils in a hot, dry district, require to be much more open in autumn and winter than the same class of soil in a cool and wet region. Example, a stiff loam in the north or north-west of Victoria may, with advantage, receive a 4 or 5 inch ploughing in autumn or early winter, whilst the same class of soil in a cold Gippsland valley would be much warmer and sweeter if left untouched. The richer the soil the more liable is it to become sour and unprofitable in winter. Where the soil of the orchard varies, and also the species and condition of trees, different treatment may be necessary, as it cannot reasonably be hoped that uniform treatment will, in such cases, bring about uniform results.

Cultivating in autumn usually makes for an exchange of heat for moisture. The arrangement of surfaces for autumn and winter are to be considered from the points of view of holding up moisture or shedding it more or less rapidly, of picking up heat, exposing or excluding wind in exact accord with what are deemed to be the best interests of the trees of different kinds and ages; thus a number of narrow lands or ridges will provide more air, warmth, and sweetness at the roots, than broad, flat lands which quickly become immersed and smooth. Ploughing up to the trees and away from them is not always right, or enough. Greater mixing of the soil, protection, and assistance in one form or another is necessary. Concave surfaces attract most moisture and least air, therefore they make the soil mass cooler than convex lands. Nevertheless, narrow concave lands with two furrows between each row of trees are usually to be desired in the hot, dry, northern areas, as a means to get plenty of water into the subsoil without stifling it, as must ever be the case where it remains flat, smooth, and undrained. The poorer the soil the longer may water remain in it without doing harm, therefore, after such land has been

ploughed into narrow ridges a cross furrow or two between every other tree tends to hold up the water until it is absorbed by the surrounding soil and atmosphere.

Once get the soil into the right condition for roots to grow, then all after treatment during winter must be with the object of maintaining such growth, at a pace in accord with the needs of the tree.

Pruning Competitions: Aids to the Work, and Judging.

No subject is more frequently discussed, or worse performed, than that of pruning, since it is rare indeed that any legitimate excuse can be offered for the loppings and choppings which are more or less regularly carried out.

Pruning to be of value implies a knowledge of the native, acquired, or desired habit of any species or variety of tree, according to the soil, climate, and general surroundings amid which it is placed. Trees to fruit over a long period must be well designed, and this design must be foreseen and not casually guessed at as the growth appears. The making of a strong, shapely, and appropriate framework is the most important thing in all trees, as with this established it is an easy matter to keep them furnished with light fruiting wood.

The ordinary divisions of pruning are as follow :—

(i.) Starting young trees.
(ii.) Pruning, disbudding, and stopping young trees whilst they are building themselves up.
(iii.) Pruning to steady the growth and induce fruitfulness.
(iv.) Pruning to maintain health, vigour, and fruitfulness.
(v.) Pruning to invigorate weakly trees.
(vi.) Pruning to throw strong barren trees into fruit.
(vii.) Summer or green pruning for wood and fruit.

All these subjects admit of subdividing and more or less varied treatment, since species, habits, soils, and conditions differ and make it impossible for one rule-of-thumb method to serve for all.

I. Starting Young Trees.

Strong and weak growers, rich and poor soils demand different shapes and sizes ; therefore, many or few branches may be desired as mains. In rich cool soils somewhat weakly trees are desired, otherwise they will not fruit regularly, whilst in poor and shallow soils trees must be stout and strong, or they will not yield good fruit and last long. When we come to start a young tree in any position, the first thing to know is its native habit, and how far surrounding conditions helped out by man's intelligence and industry will aid or hinder it. A weakly grower will be started with the strongest possible base, whilst a strong grower if in a good position will be started on a comparatively light foundation. These alterations are possible by selecting a particular length of trunk and the number and angle of growth of the first branches.

II. Pruning, Disbudding, and Stopping Young Trees whilst they are Building Themselves up.

The second, third, and fourth years' pruning are really the most important, as they permanently affect the life and value of the tree. The majority of young trees are pruned as if the multiplication table were being constantly recited, as—

> First year, twice two (branches) are four ;
> Second year, twice four (branches) are eight ;
> Third year, twice eight (branches) are sixteen ;
> Fourth year, twice sixteen (branches) are thirty-two ;

and so it goes on indefinitely until a dirty and unprofitable thicket of wood forms what is known as the orchard.

Seriously, a reasonable limit must be set to the number of branches of a main and secondary character.

The first three or four prunings *do* multiply the branches more or less rapidly, but when the habit and appropriate size of a tree are foreseen then the number of branches necessary may be quickly determined. The habit of bearing goes a long way towards deciding on the substance, number, and space between branches. Normally, the stronger the tree the wider and deeper the interspaces, as these alone will be able to carry the fruit-bearing wood.

The pruning of fruit trees during their first years, which should be their most active growing periods, is therefore concerned solely with giving good shape, substance, and space convenient to the carrying of fruiting wood. No thought is given to the actual production of fruit-bearing wood whilst the tree is growing and unformed. Make the tree first, and then good fruit, regularly and in abundance, is the result, always providing that proper after treatment is forthcoming.

Winter pruning alone will not make trees equal in form and value to those which are systematically thinned, stopped, and directed during the spring and early summer months. No late summer or autumn work should be done on young and still growing trees, as pruning in any form in late summer has a weakening effect, and this is not desirable where a further root and branch extension is sought. Thinning is done in order to give an equal chance for all branches to assume the same size, angle, and value at a given plane in the head of the tree. Thus, in practice it is often necessary to pinch a strong shoot in order to check it and allow weaker ones to overtake it. Thinning the base of branches strengthens the points, whilst thinning the points tends to strengthen and cause side growth in the lower parts of limbs. Thus, pinching and stopping may or may not be necessary, and it is unwise to pinch off a piece of wood simply because it is not wanted, unless it is seen that the result will be for good in some other direction.

III. Pruning to Steady the Growth and Induce Fruitfulness.

When trees are large and strong enough to bear fruit, pruning is done to reverse the object of the preceding years, viz., to weaken the tree as a whole or to provide light, firm, well-ripened wood, which alone

can develop perfect flower and support good fruit. The roots cannot be kept under absolute control by winter pruning, hence the management of the soil goes hand in hand with the knife work on the tree. With little or no root growth, the bark hardens, buds have little crude sap in them, and they therefore make but light wood, or flower buds on the extremities of all weak growths. If the soil conditions have been unfavorable to free root growth, there will be very little pruning necessary in order to throw a young tree into fruit; but, where the soil is still generous and roots extending freely, the branches must be kept far apart, light, and single at their points, so that no shady hood of foliage can form and render the interior of the tree barren.

IV. Pruning to Maintain Health, Vigour, and Fruitfulness.

Light, air, and a proper circulation of the sap lead to the making of healthy leaves and bark, and these are in the best position to resist the ordinary maladies which infect trees. Hence, the proper spacing of all wood is an important point in the management of fruiting trees. Complete growth alone can make for the development of flower buds and the perfecting of fruit, and it is necessary to know the nature and capacity of every piece of light wood in a tree before it can be dealt with in the most profitable manner. Spurs and shoots are strong and weak, long and short, ripe and unripe, old and young, crooked and straight, upright, horizontal, and drooping, all in one tree, and it cannot be expected that all these forms and qualities can be of equal value or require equal treatment. Again, if a tree bears on every piece of young wood one year it must be almost entirely barren the next, as fruit is never borne twice on the same point. Pruning prevents overcropping in one year, and reserves a sufficiency of wood for the next season, thereby obviating gluts and scarcity. These are but a few of many important points in pruning to keep the tree in health and profit.

V. Pruning to Invigorate Weakly Trees.

This involves the thinning out of all the weakest placed branches, and also shortening back, thinning, or removing bodily all the light wood which has become more or less exhausted. Then the tap is turned on, so to speak, at the roots, a free root extension is made, which in turn covers the old framework with a number of light branches or fruiting shoots and spurs. In so far as a correct estimate is made of the resources of the soil and tree, it will be pruned to yield useful wood in the right proportion, and at once.

VI. To Throw Strong Barren Trees into Fruit.

The work is in two directions. The root growth must be checked by drying out the soil in summer, and the bark must be hardened by exposure to strong sunlight and heat. Such treatment reduces the volume and activity of the sap, so that it makes weak ripe growth, which, providing there are no deficiencies in the soil, soon runs to fruit. Where heavy branches stand so close that there is no room for side growth to receive proper light and air and become sufficiently attenuated, then a thinning and wide spacing of the branches are a first necessity.

Much depends on species and variety, also the degree of vigour and the crudeness or complete nature of the strong wood, as to whether it will fruit freely or sparsely, and also, it may be prompt or very slow.

A tree's nature and wants may be determined on its being seen, but it cannot so easily be explained on paper.

VII. Summer or Green Pruning.

This is usually for the strong tree. It is carried out sparingly on young trees in early spring in order to check or remove altogether wood which is not wanted, and divert the sap to other channels. It is ever a weakening process, hence it must be done with care and due consideration on all young and weakly trees. With mature trees which have a scarcity of spurs or light shoots, the pinching back of these at some period of midsummer, varying according to vigour of trees and nature of climate, will lead to a second growth of a weaker and more fruitful character. The stronger the trees the more thoroughly may they be thinned and pinched over in summer. Towards autumn, normally in February and March, a certain amount of thinning is necessary to all trees which have crowded and shady interiors, as unless the sun and air act on leaves and ripen them, strong and profitable buds will not form. All these operations are known as "summer pruning," though they are carried out in spring, mid, and late summer, for distinctly opposite reasons, the first being for wood only, the second to promote fruiting wood or buds, and the third to ripen leaves and buds.

With the foregoing as a possession, the owner or worker amongst trees is justified in attempting to prune them, and in so far as he is sound in his arguments and successful in practice, he may compete for a prize, and help in the instruction of his neighbours.

The following form may prove of some assistance to associations and others—and may they be many—who wish to encourage a rational system of tree making and management, on the part of those who look to their orchards as a means of subsistence.

The writer has only to urge that judges must be competent, as should false standards be set up, more harm than good must come of pruning competitions.*

POINTS TO BE OBSERVED IN JUDGING PRUNING COMPETITIONS.

DECIDUOUS FRUIT TREES.

1. Starting young trees according to species, habits, and form desired.

2. Pruning to lay framework in two, three, and four year old trees, according to species, habit, and condition at pruning time.

3. Pruning trees nearing maturity in order to reasonably expose and harden wood, induce side growth and fruitfulness.

*** Judging which does not secure at least 75 per cent. of marks is not deserving of special recognition, as cheaply won prizes create false standards.**

4. Pruning trees in bearing so as to regulate the distribution and volume of sap, secure light and air, and a regular supply of fruiting wood.

5. Pruning to invigorate weakly trees by the reduction and shortening of branches, and by the removal or shortening of light wood.

6. Pruning to promote and develop the spur in apples, pears, and plums.

7. Pruning to throw strong and barren trees into fruit.

8. Spacing of branches, treatment of old spurs, removal of unripe and exhausted wood, admission of light and air, alteration of form with age of tree—all important points for the judge or judges to consider.

The Bulk Manures and Natural Soil Dressings Available in Victoria.

1. Farmyard and animal manures of all kinds.
2. Refuse from woolsheds.
3. " " abattoirs.
4. " " boiling-down works.
5. " " cattle-yards.
6. " " glue, starch, and jam factories.
7. " " tanneries.
8. " " retorts and gas-works.
9. " " brick and tile yards.
10. " " markets and shops.
11. " " fires.
12. Turf skimmings (the most abundant and valuable dressing).
13. Deposits of silt and humus on flats, in gorges, or by streams.
14. Dredgings from rivers, lakes, and billabongs.
15. Night-soil.
16. Road scrapings.
17. Street sweepings.
18. The drainage from sewers and cesspits.
19. Rotted hay, straw, fern, and swamp grass.
20. Leaves and bush rakings (when fermented and decomposed).
21. Peat and rich fibrous soil from old boglands.
22. Guano, existing in various caves by the sea shore and on adjacent islands.
23. Seaweed.
24. Sea shells, and shell drift which occurs here and there inland.
25. Lime, marl, gypsum, ashes, sand.
26. Green manures:—Peas, beans, vetches, cow peas, lupins, clover, rye, barley, rape, for the supply of nitrogen and humus.

The refuse of rotted timber, tanners' bark, and sawdust is always dirty, souring, and dangerous to the roots of cultivated plants, and cannot be regarded as a safe and useful soil dressing until fired and converted into ash.

The Orchard.

long rank grass or heavy weeds occur in the orchard, mow 'e to a pit where it may rot into useful manure, or feed to ther stock. Props and supports of all kinds should be rom the orchard as soon as the crop is gathered. The tree ıld be strong enough to support its crop, and where other : employed it is clear that trees have not been properly ınd cared for. However, if trees are loosely made, and bear ıme additional support must be brought in ; but it is bad to ːe in or about the trees all the year round, as they cause ıd encourage a lot of filth which could not be generated on ealthy wood.

ːm districts, where soil is mellow and sweet, citrus may be ıt. A stake should be placed to each, and the head thinned , so that the wind will have no power to blow them about here are but two or three kinds of lemon which are distinctly o, and profitable in, Victoria—the Lisbon Improved, the ːl, and the Villa Franca. The Lisbon is the best for general The Variegated has a fine quality acid, but its fruit is l the tree not at all hardy. It is best suited to the northern ıe Villa Franca gives its heaviest crop in summer, hence desire to grow it and save storing.

ːoot growth in all weakly trees by cultivating and moistening Water may or may not be necessary. In any case, the to create a *temperature and degree of moisture* in the soil to free root extension. This work of *growing* commences te, according to the season and geographical position. It is to cause the *head* of the tree to *grow* by any system of late r autumn irrigating and cultivating, as whenever this occurs roportion, or all the buds, are thrown out of use for the year. *In a mixed orchard, where trees are of various ages,* l degrees of vigour, different treatment must be accorded. encourage more root extension on the part of the young and ː, but let the strong alone till they produce more ripe and ıod on the existing framework. It is often necessary to feed on a strong tree, through the absence of moisture or sap ː in summer, but it is seldom advisable to give extra nourish- ː roots during autumn or spring. Remove any bandages which ı employed to protect weak and sensitive bark from the hot ː always advisable to keep the bark of young trees soft and ence the great value of bandaging in hot weather ; but if the uddenly exposed by the removal of the protective covering ıter, it is liable to split and cause serious injury.

ıves of all deciduous fruit trees should still be fairly strong . Yellow is the colour in autumn leaves which gives the ːin indication of weakness, as no leaf which has been properly its work well, and remained sound unto autumn, will be ːtitute of stains and blotches. Plum leaves are usually the ːll, and they are often unduly hastened by the parasitic red

spider using up all their vitality, so that they are powerless to hold on to the tree. Where leaves fall early, the buds remain imperfect, and crops must necessarily be light. Leaves should not grow in autumn, but it is distinctly necessary for them to feed and ripen well. See that the condition of the soil favours their doing this. Poor dry soils may be manured forthwith, but wherever there is danger of manure attracting too much water, lowering the temperature of the soil, and souring it during winter, manuring should be deferred till spring. According to the nature of soil, the climate, and constitutional vigour of trees, manure is applied in a falling or rising temperature. Naturally, the hardy may be manured in autumn or winter, where the weakly and sensitive require to be helped in spring or in early autumn ere the land is cold.

Table and Raisin Grapes.

At this season one is chiefly concerned in perfecting the wood for next season's crop. To this end the leaves are left open, that the bases of all shoots may be fairly exposed to the light, heat, and air. Very strong vines, and such as are trained low, suffer most from the imperfect ripening of the wood. Acres of ground may be got over in a day by a single hand in performing this work, and, allowing that there is nothing else of such importance and value as a crop of ripe, firm wood, it is well to see that the autumn and fall do not find such as is required for spurs and shoots green, coarse, and imperfect. Closely-planted vine land cannot usually be dealt with till after pruning, but it is often sorely in need of loosening and moistening in early winter, whilst at other times furrows are needed to get rid of surplus water. Young vineyards should be kept constantly worked, and there is no better period than the present for giving a light ploughing and harrowing, so as to insure a well aerated, moist, warm soil, wherein roots may grow freely and provide the means for a strong head growth next summer. Damp raisins, currants, and sultanas should be placed on wooden trays heated to 120 Far., or thereabouts, and placed in warm, sunny positions, that they may dry off. The damper the fruit the smaller the parceling, or it will ferment and spoil.

The Vegetable Garden.

April should see a reversal of form in the surface arrangement of soil for winter and early spring crops. Plenty of water is necessary for vegetables even in winter, but the drainage must be more perfect, the planting more open, and the soil arranged to attract more heat than is necessary in summer time. Well raised and narrow beds, or lands rising in such positions as will allow of the sunlight falling on the largest possible proportion of the surface will insure the soil being "quick" and suitable for winter cropping. Rank manures should not be placed in heavy or low-lying soils in autumn or winter. Such soils may need feeding badly, but the manurial dressing must be of a short or warming character; thus, well rotted and spent dung, ashes, or clean fibrous loam will attract more heat, preserve the soil sweeter, and better able to support vegetable life in a low temperature. Clay pits can easily

be made to hold liquid manure, and a few arum lilies or a shrub or two planted round keeps the spot sightly. Material from the stable, cow-shed, pig-sty, and poultry run are all excellent, and go further if placed in a pit, where they may dissolve and combine such properties as ordinary garden crops can promptly take up. Crude dry manures may lie for weeks in a winter soil and do no more than prove a positive hindrance to root formation or extension, where the same material, if properly treated and given in liquid form, would lead to free, strong growth. A little lime, as well as bonemeal or superphosphate, should be added to the liquid manure pit or barrel occasionally, in order to make the dressing a complete one. Wood ashes, too, break down more readily, and are, therefore, of much earlier value if placed in a strong liquid manure. For economy, the pit or pits should be small and the contents fairly turgid, as here the waste by evaporation is less, and, further, the labour of distribution is less, as fresh water about the garden may be used for diluting whenever crops are dealt with.

The Hardy Flower Garden.

During April a great deal of work of a preparatory kind must be taken in hand in order to keep the garden attractive during winter and the following spring and summer. Additional soil and manure is given to all low and impoverished sites which are vacant or but sparsely planted; sundry shrubs and hardy perennials will stand cutting into neat and varied form and size, and the dead stalks and flower spikes of annuals and herbaceous plants call for removal. Stakes, too, which support nothing, should be cleared off, as nothing makes a garden look poorer than a lot of dead and undecorated wood. More sunlight and heat may reach the soil than in the preceding months, that it may be kept warm and sweet, and so maintain the beauty of flowers and foliage, as well as ripen all necessary wood.

Cuttings of many softwooded things may be taken now, as, if placed in a warm sweet soil they will root quickly, and become hard and sturdy enough to tide over the winter. Autumn cuttings require to be of harder wood than those selected for spring rooting. This is owing to hard wood having more substance and less water, features which allow it to grow in the face of a falling temperature. Soft, sappy shoots rot in such circumstances, whilst the rising heat and dryer soil and air of spring rob them sufficiently to make rooting easy and sure. Select wood of good average size, which has borne strong and ripened leaves. The closer the joints the better. Leaves are not equally necessary to all cuttings, so much depends on the temperature and degree of moisture in the soil and atmosphere. The first necessity is to cause the sap to congeal and form a callus at the base end in the soil. Strong leaves pump up the sap and exhaust it, thereby reducing the callus and root-making power at the base. Little water is needed in the cuttings, but the active properties of the sap must be allowed to go to the making of roots before much or any head growth is made in the form of leaves. On the other hand, some very soft-wooded plants root more freely when a small amount of

leafage is left to the cuttings. The leaves growing steadily or already fully grown do not take as much as they give in the shape of elaborated and root-forming sap. It may be seen that fully-grown and mature leaves will not exhaust the substance of a cutting, but rather tend to strengthen it, where young and growing leaves are a weakening influence. Good gardeners regularly take off the prominent eyes as well as the leaves from some cuttings, in order to lock up the sap and secure the formation of roots.

DISEASES IN THE ORCHARD.

By A. G. Campbell.

Nowadays the orchardist finds around him a considerable number of pests and diseases, which take more than a fair share of his profit, taxing his patience and energy to the utmost, when he endeavours to fight them. These irregularities are due to various causes, which may be put into two groups—(1) internal predisposition, either from the nature of the plant or from its environment, soil, temperature, &c.; (2) external causes, or those resulting from attack by living organisms, such as animals and plants. In the latter group there are many insects which are regarded as pests because they devour various portions of a plant grown for economic purposes, and many fungi also, minute forms of vegetable life, which are parasitic on the higher forms. It must be admitted, however, that these attacks are often encouraged by the presence of the first group of causes, that is, when certain trees are so weakened in constitution by being placed in adverse conditions or under bad management, then they are subject to certain organic diseases. To have the subjects in good health is the best guarantee against these attacks.

Before the irregularities in the orchard trees can be successfully dealt with, especially those resulting from organic causes, some idea must be gained, not only of the symptoms, but also of the nature of the disease. Then, when the orchardist is sure of his ground, he can strike at the very heart of the infection, and quickly remove it.

The diseases due to vegetable or fungous organisms are, perhaps, more to be feared than insect pests, because they are so microscopically small, and grow in such an insidious manner that, in many cases, the damage is done before anything is seen of the cause. Fungi are placed by botanists very low down in the vegetable world, and are grouped with seaweeds, lichens, ferns, and mosses, as the plants which do not produce flowers, and therefore have no seed. Reproduction takes place by means of little bodies, representing seed, called spores, which appear in immense numbers. When combating fungous diseases, these spores are what the orchardist must endeavour to kill, or otherwise prevent from growing.

There are some seasons when certain fungous diseases, black spot, for instance, is much worse than in other years; the same remark applies to all fungi, but all kinds may not be prevalent at the same time, when black spot is plentiful, it does not mean that leaf rust will

be plentiful too. Each has a certain degree of temperature and moisture in which it will thrive well. All the world over, among all the vegetable kingdom, it is ever thus, that what suits one plant may not be exactly the thing for another.

Many things conspire to bring about what is termed a "bad year" for a certain pest. It may be the result of a sequence of many good seasons of growth, in which the spores become more and more numerous, until a climax is reached ; or it may be worked up in two seasons, if they be favorable. Firstly, there must be a good season for the production of myriads of spores ; secondly, this must be followed by a mild winter, during which few, if any, of the hibernating spores are killed by cold or wet ; and then, thirdly, a second good season of growth must follow to still further increase the pest. But fortunately such a combination does not often occur ; nature is to a certain extent on our side. It often happens that a "bad year," is followed by a sudden and conspicuous absence of disease ; this is due to climatic influence ; and the vagaries of climate are responsible for killing of more disease than our present irregular systems of treatment.

Spores, however, possess great vitality, and may lie for several years in a dormant state, should conditions not be favorable to growth. In this fact is found the reason that the most successful sprayings for fungous diseases are now recognised to be, not the applications in winter, but those given in spring, just when the fungi are becoming active, and seeking to obtain a hold on the unfolding leaves or newly-set fruit.

There are many fungous diseases on our fruit trees which, to some in one district and others in another, prove themselves serious pests. The principal ones will be selected, and a popular description of each, together with the readiest remedies will be given, commencing here and continuing through subsequent articles.

Powdery Mildew of Apple.—As the name implies, this fungus appears like a white down or mildew over the leaf of the apple. It is only troublesome in the cooler districts, where sometimes it spreads very quickly, attacking young leaves as they unfold, causing them to be distorted and unable to fulfil their proper functions. Both sides of the leaf are attacked, and the disease, if unchecked, will spread over a whole orchard in a short time by means of myriads of spores it produces.

The mildew is said to be particularly bad among nursery stock, possibly its ravages are more apparent among small trees. A moist, warm spring and summer are most conducive to its spread. When the young leaves are thus prevented from maturing, not only do the growing shoots become stunted from want of nourishment, but the whole tree will suffer from the exposure brought about by loss of leaves ; the fruit also will be ruined. In bad cases the result of the disease is seen the next year, even if the actual fungus is not present again, for the effect is such, that good growth and healthy fruit spurs have not been made for the next crop of fruit. So there is the necessity to check the fungus as soon as it appears, that it may not spread further,

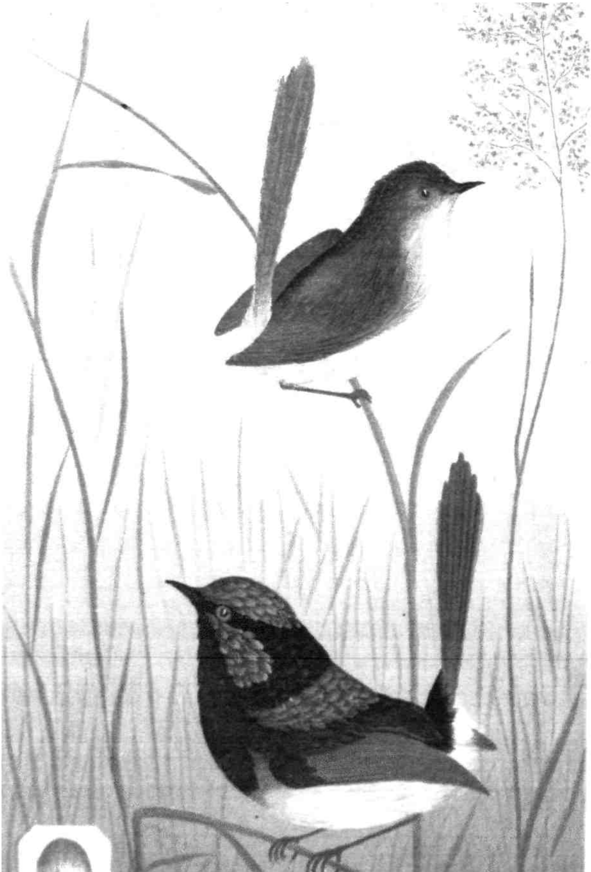
for the white downy appearance of the affected leaf is caused by the presence of countless spores, each of which is capable of being blown, or otherwise carried to new leaves, and the fungus reproduced on them.

Remedies.—In districts where the powdery mildew is known to be prevalent, or when a bad season for the disease is expected, spray early, just when the buds are unfolding, with the summer strength of Bordeaux mixture prepared by mixing 4 lbs. of sulphate of copper (bluestone), and 4 lbs. of lime in 40 or 50 gallons of water. The bluestone must be well dissolved, and the lime freshly slaked before using.

The first spraying checks the disease, by killing the fungus plants just as they are beginning to grow on the young leaves, and so the latter have an opportunity of expanding properly. But so quickly does the disease spread from other quarters that it may be found necessary to spray again in a few week's time, or even several times during the season, in order to protect the growing shoots.

Should the early spraying be neglected, and the disease be found to have a hold on the shoots in spring, it is then not too late to attack it. A spraying at once will kill numbers of spores, and prevent them spreading. Although the leaves already affected cannot be saved, yet, if the treatment be given early enough, fresh leaves will be put out in time to help the tree perform its functions during the summer.

All fallen leaves about infected trees, and the shoots which are cut off when pruning, must be burnt, because in such harbors the spores live through the winter. Were the prunings left about they would prove a menace to other trees when spring came round.



C.C. Brittlebank Del. C. French Direxit

BLUE WREN OR SUPERB WARBLER.

(*Malurus cyaneus*—Ellis.)

THE ENTOMOLOGICAL AND ORNITHOLOGICAL BRANCH.

INSECTIVOROUS BIRDS OF VICTORIA.

By C. French.

Blue Wren or Superb Warbler.

(*Malurus cyaneus*—ELLIS.)

This little gem is so well known as hardly to need much description, it being a general favorite everywhere. The mate of the Blue Wren, as the plate will show, is much more showily plumaged than the female, the lovely blue feathers forming a striking contrast to the somewhat sombre plumage of its tiny mate.

The nest of this bird is, to quote from Mr. Campbell, globular, side-top entrance; usually composed of old, greyish, weatherbeaten grass, with an admixture of cocoons, lined inside with fine, yellow-coloured grass, and finally with feathers, hair, down, seed-vessels, &c., placed near the ground in a low, dense bush or tussock of grass. The eggs are laid in clutches of from three to four, occasionally five, shape and colour as per accompanying plate.

The breeding season is included in the months from August to September to January, during which period it rears two or three broods. It is also well known, as stated by Mr. Campbell and others, to be amongst the foster-parents of the Narrow-billed Bronze Cuckoo, a valuable insect-destroying bird, about which we will say something in the near future.

This beautiful species varies considerably in its markings, but this is only to be observed by any one skilled in such matters, Mr. R. Hall, of our city, having given much attention to the subject. The male of this species is polygamous, it being no uncommon sight to witness the funny little fellow strutting about in the company of several tiny females.

The Blue Wren is strictly insectivorous, and, although small, destroys a vast number of insects. There are happily but few people who would kill one of these birds, which, to prevent their entire destruction, should be protected against all comers, no matter who or what they are.

These birds are also found in New South Wales, and, according to Mr. A. J. Campbell, in Queensland.

For more lengthy particulars of this and the other birds to be enumerated, consult the works of Messrs. Campbell, North, Hall, and others.

ECONOMIC ENTOMOLOGY.

By C. French, Government Entomologist.

The Apple-Root Borer.

LEPTOPS HOPEI, *Fahrs.*

Order: COLEOPTERA. *Family:* CURCULIONIDÆ.

We now come to one of the most destructive and most serious insect pests of the State. The "Apple-root Borer" belongs to the great family of the weevils, and is one of the largest and best known of the Victorian species. It is indigenous to Australia, and was described more than 50 years since by that great entomologist and specialist in this family, Schœnherr. More than 1,000 species of this genus have been described in various scientific publications as being found in the Australian States.

As this insect has been so recently described as a destroyer of apple trees, &c., it is considered unnecessary to do more than simply state some additional facts bearing upon matters of importance which have lately been noticed, and which must, of necessity, prove of great value and assistance to fruit-growers and others interested.

In Victoria, as has been previously remarked, this insect is fairly common, but it is only lately, and after its habits had been accurately noted, that its occurrence in such large numbers, judging from its apparently rapid rate of increase, has been observed.

At page 72 of the hand-book *Destructive Insects of Victoria*, Part I., it is stated, as my opinion, that I suspected the female to deposit her eggs beneath the soil, and near the stem of the tree. Since then, however, and owing to the observations made at my request by Mr. Geo. Powell, a fruit-grower at Castlemaine, in our State, who has been good enough to watch the case for me, it has been discovered that the female beetle (see Fig. 4) ascends the branches of the tree, having come forth from the soil at night, and with her legs folds the leaves of the tree together, fastening them with a glutinous secretion, then depositing her eggs, to the number of 40 or 50, in the manner as shown in the plate, holding the folds of the leaf together until it sticks. In some of these artificially-closed leaves the very young grubs have been taken, and these descend to the ground and there ensconce themselves in the cracks or crevices in the roots, descending either vertically or horizontally, as the case may be, when they at once commence to tunnel into the roots. The sap is thus drawn from the tree at a time when it is most required.

Having tested this matter of depositing the eggs in the closed leaves for myself, I can vouch for the accuracy of these facts as formerly ascertained by Mr. Powell.

These insects, unfortunately, do not confine themselves to attacking apple trees. They have been found to be severe on pears, apples, plums, vines, and cherry trees are also greatly injured and often killed by them.

C C Brittlebank Del. C French Direxit

THE APPLE-ROOT BORER.

(*Leptops Hopei*—FAHRS.)

Of all the many serious insect pests with which growers of apples in Victoria have to contend this beetle may be fairly set down as the most formidable. In former years it was known, as a rule, to frequent wattles (*Acacias decurrens* and *mollissima*), but on these trees I am not aware, nor can I learn from experienced observers, that it attacked the roots, and it would appear to have done but little damage to these trees, being most commonly found on the young wattles of from 6 to 10 feet high. Fortunately for the grower this beetle cannot fly, so that it cannot be spread broadcast as is the case with many other pests of the orchard, farm, or vineyard. The larva, pupa, perfect insect, and root section are also figured at page 70 of Part I., *Destructive Insects of Victoria.*

As showing the large numbers of these beetles which may now be found by a careful search, it may be mentioned that no less than 1,600 of the perfect insects have been found in one orchard within a very few months, and when we consider that a large proportion of these beetles have proved to be females, and each one of them deposits such a number of eggs, it will be at once seen with what a dangerous foe we have to deal.

A few years since, having learned of the very serious condition of the apple trees in many of the orchards around Doncaster and other places near Melbourne, I paid a visit to the former district, and, in one of the best kept orchards that I have seen in the State, I found that a large number of the trees, as had been noticed by other growers, also through the medium of the public press, were in a very bad state, the tops of the apple, pear, and cherry trees having commenced to die off, the top branches showing the first indication of the presence of some insidious foe attacking the roots of the tree, and having had some experience with trees in the Geelong and other districts in which the trees seemed to be similarly affected, I at once came to the conclusion that the same culprit was at work in these orchards. I now find that my surmise has proved to be correct, as Mr. Thiele, proprietor of one of the orchards referred to, has written me to say that, in digging up some of the apple and other trees, he found all the roots which were within 8 inches of the surface to be perfectly sound, and, from a casual examination, would appear to have nothing wrong with them, but as soon as the roots took a "dip" downwards they were eaten more or less to the depth of about 2 or even 3 feet from the surface. In some soils they may go deeper, in others shallower, but where these were taken out the soil was very firm below the trees.

It has also been found that the very bottom of the stem forming as it were part of the tap root is also attacked rendering it impossible for a tree where thus injured to recover.

Mr. Thiele has also sent me round pieces or balls of the clayey loam taken from near the tree, and from which the head of the perfect female can be seen protruding, and in a similar position the larva also. This convinces me more than ever that suffocation combined with judicious root-pruning and trapping are the best means to be adopted for their extermination when below ground.

To growers, the fact of seeing one's trees dying off one after another, from no apparent cause, is, no doubt, most discouraging; but now that we have a better knowledge of the economy and life-history of this insect we may reasonably hope to be able, by increased vigilance in picking off and burning the infected leaves between which the eggs are deposited—and which, after any one has seen the illustrations, they will have no difficulty whatever in recognising both the insects and the appearance of leaves on which the eggs, oval in shape, white in colour, and covered with a white silky film (as shown in Fig. 4), are deposited—to cope with the evil. Having in view these facts, which have been so recently brought to light regarding the life-history of the beetle, and the somewhat singular circumstances of their having left their natural food, and, unfortunately for us, adapted themselves to our introduced fruits, should cause us to seriously consider whether the assistance of the Forest Branch of the Lands Department should not be invited to co-operate with this branch of the Agricultural Department, also with growers in the event of any serious inroads of native insects taking place—that is, where forest or wattle reserves are in close proximity to either orchards or vineyards. This could, it is thought, be partly accomplished by obtaining permission from the former department to destroy any native tree which, on examination, was found to be badly infested with noxious insects of any kind, and which, as in the case of this weevil, would be likely to spread, as well in the interests of the timber and wattle-bark industry as for the farmers and fruit-growers themselves.

As an example of the serious damage caused by these weevils, Mr. King, the well-known orchardist of Geelong, informs me that for years 1868 to 1878 he had to root up and destroy no less than 13 acres of fine trees, most of which had been in full bearing. Mr. Powell also states that in his orchard, a few miles out of Castlemaine, a large percentage of his trees are dying off from the top downwards, and also remarks that in his district the beetles come out of the ground just before the buds begin to swell, laying their eggs in October and November, and by December seem to have disappeared altogether. Nearer Melbourne, however, the beetles are to be found much later on in the summer, and, in many cases, all the year round.

Prevention and Remedies.

When the leaves are on the tree, look very carefully for those that are sticking together. Pick them all off, and destroy by burning. If the fruit be on the tree, shake the branches gently over and into a sheet. When the fruit has been gathered, a much more severe shaking can be resorted to, and which, if done carefully, cannot fail to dislodge large numbers of the perfect beetles, and possibly many of the young grubs also; and as the beetles are sluggish in their movements, often feigning death, it will be no difficult matter to destroy them either by burning or scalding water, as the whole family are, as a rule, most tenacious of life and not easily destroyed when captured, excepting, of course, by

the means above mentioned. Trapping by means of zinc traps, many of which are now in use, appears to be one of the best means for capturing the insects, thus preventing egg laying, also carefully examining leaves for eggs of such insects as may have managed to ascend the trees for this purpose. The carbon process, as explained in Part I., *Destructive Insects of Victoria*, together with such improvements as are given in another portion of this part of the book, should be persevered with. Great care must be exercised when replanting an orchard, supposing the affected trees to have been grubbed out, and in this case the land should be thoroughly treated with gas-lime before replanting, as the grubs may, by the process of grubbing out, be detached from the roots, and will doubtless exist for a long time in the soil. All affected parts of the tree, both root and branch, should be at once destroyed by burning, and, if possible, in the holes from which the trees have been extracted.

The somewhat hasty plan of rooting up affected trees is to be deprecated, as with a little care and exercise of judgment many trees, even if badly affected by disease of most kinds, may be restored to health and bearing again, and in the case of this weevil scourge in particular, too much stress cannot be laid upon the value of preventive measures, such as proper cultivation, &c., &c.

As this insect, whilst in the perfect or beetle state, is now known to feed upon the foliage of the tree, spraying, if the fruit on the tree is not either ripe or ripening, must be resorted to. To do this, use Paris green, paste preparation, in the proportion of 1 lb. to 200 gallons of water. This should be applied with a spray-pump, not a syringe, which distributes the material too unequally, and also wastes a deal of it during the operation. If your cherry trees are infested, wait until your crop is gathered, then spray at once, and in the case of apples and pears it will be found a most advantageous precaution.

Root pruning is also highly to be recommended.

Where wattle trees especially are growing near an orchard, these should be carefully examined for the perfect specimens of this beetle, and the writer of these notes is one who does not approve of the hasty and so-called heroic measures so often recommended to fruit-growers and others whose trees are affected by blight. Keep your orchard clean and well looked after. Away with all prickly-acacia hedges, which are but breeding places for noxious insects of many kinds, to say nothing of harbors for rabbits, sparrows, hares, and other pests of the farmer and fruit-grower. The whitethorn, so jus..y prized for its beauty and utility, is, when not very carefully kept, a great harborer of the dread mussel-scale, &c. It would seem almost "heretical" for me to say it, but a good substantial barbed-wire fence is undoubtedly in nine cases out of ten, by far the cheapest and best fence by which any orchard can be surrounded. If shelter must be provided, let it be done in a practical and intelligent manner, always remembering when planting shelter trees to choose such as will be both ornamental and at the same time profitable. It is not part of my duty to recommend any particular plant or tree for this purpose, but this information can always be obtained on application to the Secretary of the Victorian

Department of Agriculture, whose officers are always, in matters of this kind, at the service of growers who may require their advice and assistance.

REWARDS.

It is proposed by the Fruit-growers' Association to offer a reward or premium for the best means of getting rid of the root-borer, and although the proposal is a laudable one and should be encouraged, it appears an almost hopeless task to attempt thorough extermination, as this is, owing to our vast forests, impossible. At the present time, however, experiments are being made with a view of having the various traps tested, and it may be safely asserted that the damage caused by this insect is becoming less every year.

THE "APPLE-ROOT BORER."

(LEPTOPS HOPEI.—*Fahrs.*)

Fig.

1. Branch of apple tree with perfect insects, showing female drawing edges of leaves together and depositing eggs. Natural size.

2. Larva. Slightly enlarged.

3. Pupa. Natural size.

4. Eggs on leaves, showing also silky covering to same.

5. Showing damage to apple-tree root by tunnelling.

ANIMAL PARASITES.

By A. A. Brown, M.B., B.S.

No. 3.

In the preceding number we traced the development of the egg, or œvum, of the tape-worm up to the scolex or cystic or bladder stage. The scolex stage consists of a head turned inside out, and a vesicle, or bladder, filled with fluid, and it is found existing in the body of an intermediary host. Now, each individual egg of the cystic tape-worm group is capable of giving rise to a hydatid cyst or bag, and we previously remarked that each proglottis, or segment, may contain myriads of eggs; and, if an animal swallows, as often happens, a proglottis, thousands of hydatid cysts may be developed in its body.

A proglottis is a living thing, and has the power of independent motion. It creeps about for a time on moist ground and plants. Its period of separate existence is of short duration, for its walls decay and liberate the contained ova, or eggs, which eventually become widely scattered about. It is easily seen that if a proglottis be swallowed a great number of eggs is at once introduced into the system. Into whatever organ or tissue an egg is carried it develops to the vesicular or hydatid form, and the vesicle becomes distended with a clear fluid, which may vary much in quantity. In some cases it may be only a trace, in others a teaspoonful, and in others it may be as much as four or five pints.

Occurrence of Hydatids.

Hydatid cysts are common in Australia, in both man and the lower animals. The cysts in man, in which the heads of the tape-worm of the dog (*Tænia echinococcus*) develop, may attain a huge size. The cysts may be single or compound. In the compound forms cysts may lie one within another, like the boxes in a pill-box nest arrangement. In this case the primary cyst gives rise to a secondary, or "daughter," cyst, and this floats free in its cavity. Often the secondary cyst gives rise to a "grand-daughter" cyst, and this floats in the cavity of the secondary cyst. This is called the endogenous formation of cysts, and is seen often in man and the rabbit. Again, the secondary cysts may grow outward from the primary cysts. This is called the exogenous formation of cysts, and is encountered in many animals. There is another form of hydatid—multilocular hydatid—which is composed of many vesicles of various sizes, and which may have a considerable amount of fibrous tissue developed to support the numerous vesicles. This form is common in the fowl. The ova of tape-worms are swallowed with either food or drink by the intermediary host—that is, the animal that conveys the egg of the tape-worm a certain definite stage on its journey through life. On entering the intestine the embryo contained in the egg is set

free, and, by means of the boring apparatus with which it is endowed, penetrates the wall of the gut. It is then carried by the blood-stream to some distant organ or part in which it takes up its lodgment, and is transformed into a hydatid cyst. In the case of the rabbit it is common for a whole proglottis to be swallowed, and then there is found studded in its organs and tissues (muscles, skin, &c.) cysts varying much in size from that of a pepper-corn to a cherry (measles).

Structure of Cysts.

The wall of the hydatid cyst is composed of an external soft semi-transparent laminated elastic portion, and an internal part made up of muscular fibres and delicate cells. The wall is thin and easily torn. The heads of what will eventually form tape-worms are developed from the cellular layer. The contents of the cysts consist of a clear non-albuminous fluid of low specific gravity—1007—and in the fluid is a considerable quantity of common salt.

Effect of Cysts in Organs.

The irritation set up by cysts causes a development of fibroid tissue in the organs or parts they infest, and this fibroid tissue assumes the form of a tolerably distinct membrane or pseudo-cyst, which is continuous with the tissues of the organ or part in which the cyst is lying, and cannot be shelled out. The hydatid cyst is loosely attached to the pseudo-cyst, and can be readily shelled out.

Nature of Cysts.

All the hydatid cysts that are encountered in the bodies of animals are not fertile. As a matter of fact, the common globular unilocular form is sterile. It may be encountered in any animal. In this variety the head has undergone degeneration, and consequently the hydatid is perfectly harmless to any creature that may eat it. This form that is so often seen is a traveller that has got into the wrong host by accident, and so got lost on his journey. The fertile hydatid (the true hydatid) may contain one cyst within another (endogenous formation), or may consist of a primary cyst with vesicles growing out from it (exogenous formation), and the scolices or heads developed from the inner layers of the vesicles may float about in the liquid contents. This form is extremely dangerous, as the heads, when swallowed, will develop to adult tape-worms, and so perpetuate the species.

Symptoms produced by and Changes that may happen to Cysts.

Hydatid cysts are found in almost all parts of the body. They are most common in the liver and lungs, but occur also in the brain, muscles, and subcutaneous tissue, kidneys, bones, and omentum. The growth of hydatid cysts is slow, and may continue for years.

Except when present in the brain they do not seem to cause any discomfort to lower animals; and, in them, the tendency is for the cysts to undergo degenerative processes. In man, even, hydatids have existed without provoking any marked symptoms, and the true nature of the condition has only been revealed at autopsies by mere accident. In man, if the cyst assumes certain proportions, symptoms are provoked, and the hydatid, if not surgically interfered with, may undergo spontaneous degeneration, or may burst (if situated in lung or liver) into the chest or belly cavities, giving rise to alarming symptoms. No drugs administered internally can possibly have any effect in controlling the development of hydatid cysts or bringing the processes to an end. Many persons are gulled by quack remedies which are extensively advertised to do what only the surgeon's knife or Nature itself can accomplish. Hydatid cysts, instead of bursting into the chest cavity or belly cavity, may, and often do, burst into the bronchial tubes or intestinal tract, and complete recovery may thereby result. It also not infrequently happens that hydatids, if not expelled spontaneously by bursting through the skin, or by bursting into the bronchial tubes or intestinal tract, &c., may undergo retrogressive changes. The cyst may undergo purulent inflammatory changes, and give rise to an abscess, which may burst similarly to an ordinary cyst. Again, the cysts may be converted into granular or fatty or calcareous masses, and provoke no further discomfort. These are Nature's methods of cure, and are pretty generally seen. Large hydatid cysts are frequently encountered in man, ox, pig, horse, and fowl; smaller cysts in sheep, goat, rabbit, hare, pigeon, and in the ox and pig.

Development of the Hydatid.

The development of the ova of the tape-worm has been traced as far as the cystic or hydatid stage. The hydatid is an organism locked up in the body of its intermediary host, and can make no further progress in its development until it is swallowed by the animal in whose intestines Nature has pre-ordained it to dwell as a free sexually mature tape-worm. The egg develops to the non-sexual or hydatid stage in one animal, and then this animal containing the non-sexual hydatid must be eaten by another animal, or the hydatid must escape from its lodgment, and by some means gain the intestines of another animal, before the head of the bladder worm can become a tape-worm. The heads of cestode worms are furnished with organs which differ in different animals, and it is by means of these organs that the heads attach themselves to the mucous membrane of the intestine. The heads of tape-worms inhabiting the intestines of the carnivora have suckers and a crown of hooks; in the herbivora, the heads possess suckers, but do not possess a crown of hooks. Having gained the intestine, the head fixes itself on to the mucous membrane, throws off its vesicle, and then sets to work to grow segments or joints. The last segment on the body is the first that has been formed, since all growth occurs between the head and the first segment.

Animals infested by Tape-worms.

Tape-worms are found inhabiting the intestines of mammals, birds, reptiles, and fishes; and hydatids are common in mammals and birds. The length of tape-worms varies greatly. Some may be only a fraction of an inch in length, while others may attain the prodigious length of 30 feet.

Correlation of Animals.

In glancing down the list of animals that are brought into correlation by the life-histories of tape-worms, we cannot fail to be struck with the wonderful instinct that guides these creatures through their perilous journeys to fulfil their destinies. Let us for one moment arrest our attention and dwell upon the chain of events that cannot but at once compel us to reflect deeply upon the abstruse workings of Nature. The ox has been destined to supply man with food. It is in the flesh of the ox that a common tape-worm of man (*Tænia medio-canellata*) passes its hydatid stage of existence, and it is by the consumption of raw or improperly cooked flesh of oxen that the embryo reaches the stomach of man. The flesh of the pig is also chosen by man to provide him with nourishment, and it is from pork that the embryo of the *Tænia solium* reaches the human stomach. The hare and the rabbit, and occasionally the lamb, will be run down to satisfy the voracity of the dog. It is in the bodies of these animals that the embryos of tape-worms infesting his intestines lodge until the chase yields them up to him. The cat claims the rat and the mouse as its prey, and so long as mice and rats exist, cats will be infested with tape-worms, since it is in the bodies of mice and rats that the hydatid stages of tape-worms of cats are passed. The carnivora generally become infested with tape-worms through introducing the embryos into their stomachs by means of the animals which they devour as prey. The herbivora, on the other hand, become infested with tape-worms through drinking water in which or eating plants upon which the embryos flourish. The tape-worms of vegetable feeders lay eggs just like the tape-worms of flesh eaters; but their embryos, by means of a special ciliary covering, move about and flourish in water. It is when roaming over contaminated marshy places, and drinking of the waters of marshes, that the herbivora become infested. Birds prey upon slugs, caterpillars, &c., and it is in the bodies of these creatures that the larval stages of their tape-worms are passed.

VEGETABLE PATHOLOGIST'S BRANCH.

EXPERIMENTS IN THE PREVENTION OF STINKING SMUT OR BUNT OF WHEAT.

By D. McAlpine.

The experiments during the past season were confined to the three principal substances which are known to prevent the germination of the bunt spores, and the relative effects on the germination of the grain were carefully noted. The substances used were bluestone, corrosive sublimate, and formalin.

The same variety of seed-wheat was used in all the plots, viz., Queen's Jubilee, and infected with the spores of the fungus, the smut balls being taken from a very dirty sample, crushed up, and thoroughly mixed with the grains to be sown.

The bluestone solution was made at the rate of 1 lb. sulphate of copper to 5 gallons of water, and the infected seed was dipped in this solution for one minute, and then spread out to dry before sowing.

The precautions to be taken in pickling are to see that the bluestone is of the right quality, and not the impure substance sold as agricultural bluestone, and adulterated with sulphate of iron ; that the seed is thoroughly wetted ; and that the pickled wheat is not contaminated again by being placed in bags which have had bunted grain in them.

The well-known antiseptic corrosive sublimate was dissolved in water at the rate of 1 lb. to 100 gallons, and the infected seed dipped in it for three minutes, and sown after drying. It dissolves more quickly in hot water, and takes some time even then.

Formalin of the trade is a 40 per cent. solution of formaldehyde, and this was used at the rate of 1 lb. to 50 gallons of water, and 1 lb. to 100 gallons. The seed was soaked for ten minutes, and then sown after drying.

After treatment, 1,000 grains were sown in each plot, then the number of plants were counted after germination, and finally the bunted plants were carefully looked for at harvest time.

The accompanying table shows the result of the treatment, and its effect upon the germination of the grain. In each of the treated plots there was no bunt, while in the check plot alongside of the others only 5 per cent. of plants were clean.

As regards germination, however, the highest percentage was obtained in the untreated plot, viz., 96, thus showing that in checking the germination of the spores of the fungus the grain is also injuriously affected. The corrosive sublimate came next with a percentage of 71, the two formalin solutions 62 and 69 respectively, and the bluestone was the most destructive of all to the grain, only 46 per cent. germinating.

In order to test the efficacy of the treatment on a larger scale, half-acre plots will be sown next season under similar conditions, and the results should show conclusively which of these three solutions are the best for the prevention of stinking smut in ordinary field crops. In addition, the new fungicide "sar" (essentially sodium sulphide), recommended by the United States Department of Agriculture, will be given a trial.

TABLE I.—RESULTS OF TREATMENT FOR BUNT.

Treatment.	Grains Sown.	Grain Germinated.	Percentage of Germination.	Percentage of Bunted Plots.	Cost of Treatment per 50 gallons.
Bluestone, 1 lb. to 5 gals. of water ...	1,000	459	46	...	3s. 4d.
Corrosive sublimate, 1 lb. to 100 gals. of water	1,000	712	71	...	2s.
Formalin, 1 lb. to 50 gals. of water ...	1,000	621	62	...	2s. 6d.
Formalin, 1 lb. to 100 gals. of water ...	1,000	692	69	...	1s. 3d.
No treatment	1,000	960	96	95	...

WHEAT EXPERIMENTS AT PORT FAIRY AND IN THE MALLEE.

By D. McAlpine.

From the constitution in 1890 of a committee by the Australasian Association for the Advancement of Science to investigate the question of "Rust in Wheat," and my appointment in the same year as Vegetable Pathologist, continuous experiments have been carried out. Port Fairy was originally chosen for experimental purposes by Mr. A. N. Pearson, when Agricultural Chemist, mainly because of the presence there of such a successful farmer as the late Mr. Jno. Goldie. It was my privilege to be associated with him up to the time of his death last year, and in him the State has lost not only a valuable citizen, but the farming community one of its most progressive and representative members. His large experience and extensive knowledge of agriculture were always willingly placed at the service of the Government, and any work intrusted to him was faithfully and conscientiously carried out. His son, Mr. Wm. Goldie, who has been well trained by his late father in all that relates to farming, continues to act as assistant. At Port Fairy wheat experiments have been carried on continuously for ten years, the primary object being to secure wheats which would be rust-resistant. To this end numerous varieties from different countries were grown, and such *selected* as combined rust-resistance with other desirable qualities. Cross-bred wheats were also provided by Mr. Farrer, Wheat Experimentalist of New South Wales, and here a process of selection was also carried out with the same object in view. Thus by *selection* and *crossing* wheats are being evolved suited to *Australian conditions, which means that they are fitted to resist rust*, and generally have good yielding and milling qualities.

In the Mallee districts it was decided by a former Minister for Agriculture (Mr. Taverner) to test different varieties of wheat in order to determine, after at least a three years' trial, which were the most profitable to grow, and the most suitable to the prevailing climatic conditions. This is now the third year of these experiments, and they have clearly shown that by means of suitable varieties and proper cultivation a largely-increased yield may be obtained. The varieties that have turned out best, as shown by the tests, are Improved Allora Spring, Hudson's Early Purple Straw, Queen's Jubilee, and Outpost.

Scope of the Work.

The wheats are first tested at Port Fairy, and the usual course followed in order to ascertain their rust-resistance is to sow the seed at first in small quantities, say from 20 to 50 grains, in what are called for distinction's sake "Single Seed Plots." Selected seeds of each variety are sown by hand on well-prepared land in rows 18 inches apart, marked out by the Planet Junior. Six inches space is allowed between each seed so as to permit of full development of the plants.

Then if considered worthy of further trial the same variety is again sown on Medium-sized plots, after careful selection of the seed, and finally grown on a large scale in Big or Field Plots. During the past season 76 varieties were tested in the Single Seed Plots, 19 in the Medium-sized Plots, and 12 in the Field Plots.

Selection of Seed.—When a variety is found to promise well, and possesses the necessary rust-resistance, it is selected for further trial. The best ears of the best plants are saved from such plots, the tips and the butts are removed, and the large well-nourished grains towards the middle are selected for next year's sowing.

In selecting plants for seeding purposes, great care is exercised. The nature of the early growth is attended to, whether upright or creeping; and the character of the flag, whether tough or flabby, narrow or broad, glaucous or light green. The stooling qualities are also noted, and when heading is about to take place, the property of earliness is closely watched, and the date of heading is invariably given, while the individual plants which are the first to head are specially marked. Then the character of the ears and the grain is particularly noted, together with the holding or shelling of the grain. The character of the straw, too, is an important factor, whether weak or flexible, stiff or brittle, long or short; and finally the rust-resistance is carefully determined. The plots are first examined for rustiness immediately after flowering and just before reaping, and the particular kind of rust is specially noted—whether the earlier less injurious *Puccinia triticina*, or the later very harmful *Puccinia graminis*.

The most promising varieties are then tested in plots of one acre each in different districts to determine their suitability, and how far resistance to rust in one locality holds for a different set of conditions in another locality. This has been done for the past three years under my own supervision in different parts of the Mallee, where the introduced varieties were sown alongside of those generally grown, and in this way some prolific wheats, such as Queen's Jubilee, have been brought under the notice of farmers. Small samples of the most promising kinds have likewise been distributed to a number of farmers, and Mr. Pearson received a number of varieties for trial in connexion with the manurial tests.

Thus a process of careful seed selection has been going on for many years, and the result is a number of improved varieties, which are gradually being introduced into general cultivation.

Cross-breeding.—This work has been undertaken by Mr. Farrer, Wheat Experimentalist of New South Wales, and the methods adopted were fully explained by him in a paper read before the Sydney meeting of the Australasian Association for the Advancement of Science, entitled, "The making and improvement of wheats for Australian conditions." He sends out each year a number of crosses for trial and fixing, and at least two of them have been successfully and profitably grown in various districts of the State of Victoria. Queen's Jubilee is one of these crosses, and since it was the premier wheat of the season, as far as yield was concerned (42 bushels per acre), at Port

Fairy in 1897, I gave it what I then considered an appropriate name. It is comparatively early, heading on 25th September, and ripe on 7th November in the Mallee. It has many good qualities, strong straw, splendid heads, plump grain, holds the grain well, and is a good stooler. It also stands drought, and is not tipped, but is very rust-liable, although it may prove rust-escaping to a large extent, and not much damage be done to the grain on account of its earliness.

Rerraf, on the other hand, is a remarkably clean wheat, and so far one of the best rust-resisting varieties we have. It is an early wheat, and holds the grain well. At Port Fairy this season it was one of the best yielders, giving 40 bushels to the acre of well-filled, plump grain, and thus it equalled Queen's Jubilee. It is also an excellent hay wheat. At Waitchie, near Swan Hill, one of the Mallee farmers who has been growing this wheat writes under date 22nd December—"Very few farmers will get an average yield of 4 bushels per acre, while some are barely getting back the quantity of seed sown. I got 10 bushels per acre of Rerraf off an exceptionally good 2-acre piece of fallowed land, and this is the best yield I have yet heard of."

Results at Port Fairy (Mr. Goldie's Farm).

Single Seed Plots.—The land chosen for these plots was under mangels last year, to which the following manure had been applied :—

Concentrated superphosphate	$1\frac{1}{2}$ cwt.
Nitrate of soda	$1\frac{1}{2}$,,
Salt	1 ,,

After this crop had been removed, the land was in good tilth and allowed to be just as it was until ploughed in July, and then sown. Of the 76 varieties tested, among which were a number of cross-breds supplied by Mr. Farrer, only fourteen were considered worthy of further trial, and they are the following :—

1. Hudson's Early Purple Straw.	8. Early Lambrigg.
2. Budd's Early.	9. Carbine.
3. Nut Cut.	10. Eye-bright.
4. Rooney's Rust-resisting.	11. Light Hoof.
5. Jonathan.	12. 38 (c).
6. Field Marshal.	13. 58 (c).
7. Field Marshal × Lambrigg Oustler.	14. 141 (a).

Medium-sized Plots.—After generally two years' trial in the Single Seed Plots, the promising varieties are reserved for trial on a larger scale, according to the amount of seed available. These plots are of sufficient size to show the leading characteristics of the variety, and give a fairly accurate idea of the yield. They also allow the milling qualities to be determined, and this is a most important element in settling the value of a wheat. Of the nineteen varieties grown only three were retained viz:—Steinlee, Improved Allora Spring, and Steinhock × Steinwedel × Early Baart.

Big or Field Plots.—The land was under potatoes last year, to which farm-yard manure had been applied, and it was ploughed to the average depth of about 5-6 inches. There were about 2 acres under crop altogether, and among the twelve varieties tested there were

several old varieties obtained from different districts of the State and tried alongside the more recent ones. These were all found to be more or less unsuitable and accordingly rejected. They were—Purple Straw, Red Tuscan, Dart's Imperial, Smith's Nonpareil, and Steinlee, the latter, however, rejected on account of being mixed up with another wheat. The seven varieties retained are all fairly good yielders, and some of them, such as Rerraf, are noted rust-resisters. A general crop of any of these varieties may now be grown and sufficient seed raised for testing on a large scale in different districts.

TABLE I.

VARIETIES RETAINED FROM BIG PLOTS.

Variety.	Area sown.	Yield per acre.	Remarks.
Ranji	One-fourth acre ...	35 bushels	Rather pinched.
Rerraf	One-sixteenth acre ...	40 ,,	Well filled plump grain although small.
Jade	One-eighth acre ...	25 ,,	Rather small and pinched by hot winds.
Outpost	One-forty-eighth acre	30 ,,	Good grain.
Mentor	One-twenty-fourth ,,	30 ,,	A hardy wheat with good straw.
Improved Allora Spring ...	One-eighth acre ...	25 ,,	Liable to shell.
Queen's Jubilee	Three-fourth acre ...	40 ,,	Considerable amount of rust.

Results at Waitchie (Mr. Cobham's Farm).

The site selected for these plots consisted of low-lying land, a western slope, and a sand hill. The whole of the land was of good quality, but, whereas the sandy loam portions held the moisture well, the low-lying land was of a firmer texture, and the dry season did not provide sufficient moisture to develop and mature the crop. In fact, in the stiffest soil hardly any seed germinated. For this reason the yield, which was very low for the first plot, gradually improved as a larger proportion of sandy loam was reached, so that the yields of the different varieties vary so much according to the nature of the soil that they afford no indication whatever of their respective values. Suffice it, then, to say that they varied from 10 bushels 1 lb. per acre down to 3 bushels 45 lbs. per acre, while the average yield of the whole district was about 2 bushels per acre.

The past year was the driest but one during the last 33, and was a very bad season. In such a season as the past good and bad varieties may be grown alongside of one another and all are more or less stunted and damaged, their growth and development retarded, and not one is able to show the yielding capacity up to its full strength. For the testing of varieties as to their yielding capacity it is essential that the season shall be sufficiently good to provide enough moisture to bring them to a proper state of development and to maturity, but for drought resistance, which is an essential characteristic of a wheat in a dry and hot climate like the Mallee, the past season was a very trying one. There was just enough moisture to develop properly in 1900; in

1901 there was not. In 1900 "Queen's Jubilee" and "Outpost," wheats growing side by side, yielded 21 bushels 17 lbs. and 20 bushels 17 lbs. respectively. In 1901 the former yielded 6 bushels 5 lbs., the latter 9 bushels 42 lbs. The respective yields of last season were certainly misleading as an indication of the relative merits of the two wheats. Again, "Jade" yielded 3 bushels 45 lbs. as an outside plot, while a portion of the same seed sown in a centre plot gave 9 bushels 4 lbs. Making due allowance for the variability of the soil and the climate, it is at least necessary to have a three years' trial before any just estimate can be formed of the yielding capacity of a wheat and its suitability to a given district.

Rainfall.

The total rainfall for the year was 8 inches, but of this only 5·93 inches was of use to the crop, falling between dates of sowing and ripening. It fell as follows:—

June	1·07	inches
July	1·10	"
August	1·47	"
September	1·09	"
October	0·95	"
November	0·25	"
Total	5·93	"

This rainfall was preceded by eight months of very dry weather, only 3·37 inches falling during that time.

Cultivation and Sowing.

The land was fallowed 5 to 6 inches deep the previous September, and then harrowed. Just previous to sowing the land was disc-harrowed and harrowed, the plots being sown on 3rd, 4th, and 5th June, all being drilled in with 18 lbs. concentrated superphosphate per acre. There was no after cultivation.

Remarks on Varieties.

A.—One-acre Plots.

Queen's Jubilee.—A good all-round wheat, which proved eminently successful the two previous seasons. It has proved its superiority to the older wheats generally grown in the past, and judging by the demand that has sprung up for it, it is destined to come into general use in the near future.

Rerraf.—A promising early variety with good head and straw. It stools moderately well, and has plump grain which is held fairly well. In contrast to "Queen's Jubilee" this variety has proved itself remarkably rust-resistant.

Outpost.—An early and good stooling wheat, which is very hardy and suitable in every way. Tried for three years in succession, and always with success.

Rattling Jack.—As a rule, late wheats are not suitable for this climate, but this appears to be an exceptionally good late wheat, stooling very well, and being apparently hardy and prolific. It has a short, plump grain, which it holds fairly well, and is certainly worthy of further trial.

Jade is a good early wheat, which seems to yield heavily, and has no defect. It stools well, and has a large, plump, heavy grain, which it holds fairly well.

Ranji B.—A fair stooling wheat, very early, and suits the climate. Long, plump, and heavy grain, which is fairly well held.

Hermit.—A poor stooling wheat with weak straw. It is very early, and has very large, long, plump grain of a good colour, but the grain is so firmly held that it is difficult to thresh. It is a pity that a plant which produces such splendid grain should have such serious defects.

B.—Grown in Small Quantities in Plots of Varying Areas.

Output.—Of the same breeding as Outpost, but a different selection. The two wheats are very similar, but Output grain seems rather smaller than that of Outpost.

Straightvote.—A good stooler, and seems suitable to climate. Grain slightly shrivelled; 23 lbs. obtained from 1 lb. of seed.

Japan F.—A very early, bearded wheat; straw short and weak; a bad stooler, very liable to shell, and in every respect unsuitable.

Yandilla.—A rather late wheat, but a very promising variety, with a handsome square head on a good firm straw. It is a very good stooling wheat, and holds the grain very well. It is well worthy of further trial.

Shelling or Holding Grain.

Owing partly to the scarcity of suitable labour for harvest work, these plots were not stripped until towards the end of January, fully two months after they ripened. The summer was exceptionally stormy, hence the test of the holding capacity of the wheats was an exceptionally severe one. "Japan F" was the only variety to shell badly, while "Hermit" holds the grain so firmly that it cannot be properly threshed. These wheats show the two extremes in this respect, and both are unsuitable.

Concluding Remarks.

Mr. Cobham has taken a keen practical interest in these wheat variety tests from the start, and, therefore, his opinion as to their utility is worth quoting:—"There can be no doubt that the variety tests of wheat which have been carried out for three years have been of much benefit to agriculturists and to the State, and too much credit cannot be given to the Hon. J. W. Taverner for his action when Minister of Agriculture for appointing experimental blocks in the Mallee. At least two varieties of wheat which three years ago were quite unknown to farmers have clearly demonstrated their superiority to the best wheat previously known. The two varieties which stand

out most conspicuously are 'Queen's Jubilee' and 'Outpost.' Farmers, recognising their value, there has been a great demand for the seed, and it has been distributed from here in almost every part of the State, while some was also despatched to different districts in New South Wales. A small packet of 'Queen's Jubilee' was sent to New Zealand, but it was not successful there, the climate not apparently suiting it. A bag of each variety was sent to England last year for trial, and these two wheats are now growing there, alongside of the old-established strains. As far as Victoria is concerned, there is every probability that the general use of these varieties will in the near future have the effect of increasing the general yield of wheat. 'Queen's Jubilee' is the variety which has been most largely distributed, and not only in different parts of the Mallee, but also in the Goulburn Valley, at Port Fairy, the Leongatha Labour Colony, and in other parts, this wheat is rapidly achieving an excellent reputation. An endeavour should be made to find still more promising varieties, which shall excel the best we now know."

TABLE II.

VARIETY TESTS OF WHEAT—COMPARATIVE YIELDS.

Variety.	Yield.			Average for three Years.
	1899. bush. lbs.	1900. bush. lbs.	1901. bush. lbs.	bush. lbs.
Improved Allora Spring ...	25 48	20 34	—	—
Hudson's Early Purple Straw ...	18 56	—	—	—
Queen's Jubilee	24 8	21 17	6 5	17 10
Rattling Tom	19 44	—	—	—
Mentor	21 20	17 34	—	—
Outpost	23 44	20 17	9 42	17 54
Rerraf	—	—	10 1	—

It has to be noted that manure was only applied to the plots last year.

Results at Nhill (Mr. Batson's Farm).

Of the varieties grown in the Experimental Plots in previous years, six were chosen as being the most promising and evidently suited to the district. They were sown on 23rd and 24th May, in plots of 1 acre each, without manure, and the rate of seeding was the same in all, 45 lbs. per acre. The season about sowing time was a very bad one, only a few showers falling, and consequently onl, a small percentage of grain germinated, resulting in the plots being very thin. The rainfall for the year was 12 inches 31 points, and in April only 77 points fell, while in May there were only 20 points.

The crop was fed off with sheep about the end of July, and this improved it considerably, but the weather afterwards was very unsuitable for wheat-growing, as there were heavy rains towards the end of September and in October. Then close muggy weather prevailed, with heavy fogs in the morning and a hot sun during the day, thus encouraging the spread of rust. As a matter of fact, Queen's Jubilee was

worse with rust than Golden Drop, which is generally considered the rustiest of all, and yet it turned out well in the general crop, yielding seven bags to the acre in one instance. Further, the plots as well as the fields ripened very unevenly this year, some large patches being dead ripe, while small patches were quite green. As the result of three years' trial, the average yields of the six varieties referred to are given in Table III., and it will be seen that the best yielder was Improved Allora Spring, while Hudson's Early Purple Straw and Queen's Jubilee were practically equal.

Several of the wheats were sown in bulk this year with drill and manure, and it is astonishing how well some of them turned out.

Mentor drilled on black fallow land with 20 lbs. concentrated superphosphate to the acre gave 30 bushels per acre, Fill Bag gave 26 bushels, and Rattling Tom 21 bushels. Fifty acres of Queen's Jubilee was drilled in without manure early in April, but owing to unfavorable weather only a small percentage came up. The yield was 16 bushels per acre, although some of the plants were very rusty.

Five and a half acres of Hudson's Early Purple Straw yielded 21 bushels per acre.

Thus several good wheats have been introduced into the district, and the results obtained have been witnessed by a large number of neighbouring farmers. No doubt farmers will see it to be to their own advantage to grow those wheats which yield well and are suited to the *district*.

TABLE III.

VARIETY TESTS OF WHEAT—COMPARATIVE YIELDS.

Variety.	Yield.						Average for three years.	
	1899.		1900.		1901.			
	bush.	lbs.	bush.	lbs.	bush.	lbs.	bush.	lbs.
Improved Allora Spring ...	21	52	19	0	16	18½	19	3½
Hudson's Early Purple Straw ...	23	8	17	59	15	5¾	18	44¼
Queen's Jubilee	24	0	16	18	15	33	18	37
Rattling Tom	26	24	12	55	11	9½	16	49½
Mentor	24	0	11	30	9	52½	15	7½
Outpost	22	0	9	28	12	55	14	47¾

Results at Swan Hill (Mr. Bryan's Farm).

The soil on this farm is true mallee land, consisting of firm sand. The yields were so poor on account of the unfavorable season that no special record was kept of them, but there were two varieties which surpassed the others. Queen's Jubilee returned a bag to the acre, and Outpost a little over a bag, so that these are the only wheats of the new varieties tried which seemed to be suitable to this class of land and the weather conditions prevailing there. Rattling Tom and Farmer's Friend are considered about equal to Purple Straw as late wheats, and will be further continued.

EXPERIMENTS WITH OATS AND BARLEY.

By D. McAlpine.

I.—Oats.

Eleven different varieties of oats obtained from Dookie Agricultural College were tried in the single seed plots. The majority of them were too late for the Port Fairy district, as the grubs appear and strip such late varieties before they ripen.

Only three were retained as suited to the district, viz., Algerian, Skinless Oat, and Bonanza, though the last is, however, very late.

The following were the varieties, and were all sown on 12th July, at the same time as the wheats :—

1. Golden Oats.—Too late for district.
2. Calcutta Oats.—Very early, but too short in straw, and not prolific
3. Winter Oats.—Too late.
4. Prize Cluster Oats.—Far too late.
5. *Triumph White Oats.—Too late.*
6. Skinless Oats.—Good strong straw, and early.
7. Bonanza.—Very late and coarse.
8. Black Tartarian.—Too late.
9. Algerian.—Very suitable to district. Stem slightly rusty.
10. *Newmarket White Oat.—Too late.*
11. French Grey Oat.—Too late.

Half-an-acre of Surprise Oats was tried at Waitchie, in 1900, from seed grown there in 1899. It is a short plump oat, and with sufficient moisture attains a great height, and yields heavily. It might do well under irrigation, but is not recommended for the mallee.

II.—Barley.

In 1899, ten varieties of barley were tested at Waitchie, some of which had been obtained from Dookie Agricultural College, and some from Woburn Experimental Farm, England. One hundred seeds of each variety were sown on 10th April, the seed being put in by hand 2 inches deep in rows of twenty. There was a space of 8 inches between each seed, 12 inches between each row, and 3 feet between each variety.

In consequence of the ground being only moderately moist when sown, they came through the ground at irregular intervals. No rain came to assist germination until the 23rd April, when 81 points fell, and the soil was thoroughly saturated.

All these barleys showed very prolific growth, and were well headed, the "Chevaliers" and "Hallett's Pedigree" being particularly fine plants.

TABLE I.

Variety.	Whence obtained.	Germinated.	Approximate Yield.
Chevalier P	Dookie	97	$3\frac{1}{2}$ lbs.
Chevalier F	"	95	$3\frac{1}{2}$ "
Italian Battledore	"	87	3 "
Goldthorpe	"	85	$3\frac{1}{2}$ "
Imperial	"	84	$3\frac{1}{2}$ "
Prize Prolific	"	92	$3\frac{1}{4}$ "
Chevalier	Woburn	91	$3\frac{1}{2}$ "
Californian Chevalier	"	97	4 "
Hallett's Pedigree	"	88	$3\frac{1}{2}$ "
Golden Melon	"	92	3 "

In 1900, Hallett's Pedigree was again tried on an area of $\frac{1}{10}$th acre, and yielded at the rate of 22 bushels per acre, but as the mallee was found to be too dry for English barley, no further trials were made.

In 1901, seed was taken from the ten varieties grown at Waitchie, and sown in the single seed plots at Port Fairy on 12th July. They did not turn out well, and many of them were rather late. Mr. Barrett kindly reported on their malting qualities, but the best of them were only "fair." Prize Prolific, Golden Melon, Chevalier F, and Goldthorpe were all too late, and discarded. Chevalier P, Imperial, and Italian Battledore were early, but useless for malting, being too weathered, while Hallett's Pedigree, Californian Chevalier, and Chevalier, all from Woburn, were retained for further trial.

CEREAL RUSTS.

By D. McAlpine.

A.—Wheat Rusts.

To the practical farmer who is interested in the rust problem from a pecuniary point of view, the main question is how to prevent the loss from rust, and to him the cause of the loss is a very secondary consideration. He simply wishes a prescription to enable him to get rid of it, but in order to answer his question satisfactorily it is necessary to consider the cause of the loss.

What is Rust?

The rusts are non-flowering plants belonging to the fungi, the division in which are also included the mushroom and the toadstool. While the latter are usually found upon dead animal or vegetable matter, the rusts are only able to grow upon certain special living plants. Even among the flowering plants similar cases of parasitism are often observed, the most notable, perhaps, being the dodder of lucerne. The comparatively large size of the dodder, with its conspicuous clusters of flowers, renders it an easy task for even the most casual observer to recognise that he is dealing with a plant. With the rusts, however, and they are typical of many other microscopic fungi, the position is far different. A rusty powder is, perhaps, seen on a leaf; the why and wherefore are not apparent, hence the variety of crude theories advanced from time immemorial to account for the trouble. If we examine with a microscope the rusty powder on the wheat plant it will be found to consist of thousands of minute rounded or oval bodies or spores, corresponding to the seeds of the higher plants. Only a very small proportion of the many millions of spores produced in one season are able to survive upon the stubble or on the ground till the following year. If one of these in the early spring should come in contact with the leaf of a wheat plant it sends forth a fine germ tube or root, which enters the substance of the leaf, branching and spreading within, robbing the wheat plant of its nourishment, and conveying it to a certain favoured spot, where a swelling begins to form. This swelling or pustule is the spot where a new crop of spores is being produced, and at length he skin of the leaf is ruptured, and the rusty powdery mass of spores is set free to further spread the disease.

How Losses from Rust may be Reduced.

As to a remedy, the most effectual would be to remove or destroy the cause, but since the attacks of the rust cannot be checked by treating the seed wheat as in the case of smut, and since there are mechanical difficulties in the way of spraying the crop, advantage has

to be taken of the observed and recognised fact that in certain areas some varieties are much more liable to rust than others, or, in other words, some are much more rust-resistant.

Rust-resisting Wheats.—Starting from this as a basis, I have for a considerable time been growing a large number of wheat varieties at Port Fairy, and *selecting* those which in a rusty season were least affected, and if upon further trial they were found to combine the property of rust-resistance with other desirable qualities then they were sent out to other districts to see if they still retained this characteristic under the changed conditions.

This selection for rust-resistance was not only made from varieties already established and known, but as Mr. Farrer, the Wheat Experimentalist of New South Wales, has made a specialty of the cross-breeding of wheats suited to Australian conditions, I have been indebted to him for an annual supply of crosses for trial, and they are subjected to the most severe tests as far as their relation to rust is concerned. Cross-breeding is necessary in addition to selection, because new varieties are thereby developed which have the important quality of rust-resistance combined more or less with other desirable qualities, and these characters can be fixed by a process of rigorous selection.

In this way, by means of *selection* and *crossing*, wheats are being obtained adapted to our special conditions, and having the valuable quality, among others, of withstanding the attacks of rust. I would desire here to repeat what I have often before insisted on, that there is no such thing as a rust-proof wheat, that is, a wheat which under all conditions of soil and climate, of heat and moisture, will be proof against infection from rust spores. But there are rust-resistant wheats, or wheats which in a rusty year are only very slightly affected by the rust, so that their yields are not appreciably reduced. Such wheats have been produced, of which the best at present is probably Rerraf, and these are now being distributed to farmers in small quantities.

Rust-enduring Wheats.—Contradictory as it may appear, there are some wheats which are very rusty and yet do not seem to suffer much, to judge from the yields. This may be owing to the possession of a hardiness of constitution which enables them to thrive in spite of the rust, or that the factors favorable to the development of the rust are at least as favorable to the development of these special varieties of wheat. Or we may say that some varieties are such gross and vigorous feeders that they are able to obtain from the soil in the exceptionally wet springs when rust is prevalent such an increase in food materials as to enable them to produce a yield as large, and of as good quality as that obtained in an ordinarily favorable season.

Kinds of Rust.

We know that there are different kinds of rust—some injurious, some harmless, or nearly so; hence it becomes necessary to distinguish

these rusts in the selection and breeding of wheats. On the wheat only two kinds have been found in Australia, the Spring rust (*Puccinia triticina*), and the Summer rust (*P. graminis*), the latter being much more injurious.

There are certain characteristics pertaining to each of these rusts by which the experienced observer can readily separate one from the other. In the "Red rust" stage, which is the more familiar to our farmers, the Spring rust is almost exclusively confined to the flag, where the pustules or spore beds are small and orange coloured. In the Summer rust, on the other hand, on the flag, sheath, and stem the pustules often take the form of long, red powdery lines, much darker in colour than those of the Spring rust. Later in the season, just as the wheat is about to ripen, what is known as the "Black rust" stage is found. In this form the Spring rust produces very small, oval, brownish-black pustules, always covered by the skin of the leaf, and generally placed on the lower side of the flag, close to its junction with the sheath, or upon the upper inch or two of the sheath itself. The Black rust stage of the Summer rust is very easily distinguished, since the pustules are generally very much larger, often forming long, black lines. They always burst through the skin, and are not covered, and are of a deep, velvet-black colour.

Results Obtained in the Experimental Plots.

There was a good deal of rust during the past season in different districts, and most of the varieties grown at Port Fairy were badly affected, so that it seemed a favorable season to determine the proportion between the Spring and the Summer rusts for each variety tried.

Each plot was carefully examined as it grew, and the rustiness was noted on the 27th December, according to a scale which I have adopted—

No rust
Trace
Practically clean
Very slight
Slight
Very moderate
Moderate
Moderately bad
Bad
Very bad
Rotten with rust.

By means of the above graduated scale, adapted for field use, the relative rustiness can be expressed in such a way that the degree of rustiness among a number of varieties is comparatively shown, and "moderate" rustiness may be taken to mean that the limit of safety has been reached. Then, in addition to the "degree of rustiness," the relative proportion of Spring to Summer rust can be expressed in figures in the form of a rough approximation of the area covered by by the pustules of Spring rust in proportion to that covered by the Summer rust.

TABLE I.

Proportion of Spring to Summer Rust in Wheat Plots.

Plot.	Variety.	Degree of Rustiness.	Spring Rust.		Summer Rust.		Proportion.	Remarks.
			U.	T.	U.	T.		
1	Queen's Jubilee (Ballyrogan)	Bad ..	×	O	×	O	1 : 1,000	
2	Steer's Early Purple Straw	Bad ..	×	×	×	×	1 : 1,000	
3	North Carolina ..	Bad ..	O	O	×	×	..	Only Summer rust
4	Hudson's Early Purple Straw	Very bad	×	O	×	×	1 : 1,000	
5	Allora Spring	Bad ..	×	O	×	×	1 : 1,000	
6	Outpost	Very bad	×	O	×	×	1 : 1,000	
7	Jade	Rotten ..	×	O	×	O	1 : 2,000	*P. triticina* very scarce
8	38 (C)	Moderate	×	O	×	×	1 : 100	
9	58 (C)	Moderate	×	O	×	O	1 : 10	
10	Belatourka	Practically clean	×	O	×	O	1 : 50	
11	Budd's Early	Slight ..	×	O	×	O	1 : 10	
12	60 (A)	Bad ..	×	O	×	O	1 : 1,000	
13	Nimitybelle	Very bad	×	O	×	×	1 : 2,000	
14	Queen's Jubilee (Port Fairy)	Rotten ..	×	O	×	×	1 : 2,000	*P. triticina* very scarce (Plots 13–15)
15	Jackal	Bad ..	×	O	×	O	1 : 2,000	
16	Dominion	Practically clean	×	O	O	O	..	Only eight specks on plant
17	Pictet	Moderate	×	O	×	O	1 : 100	
18	Sullivan's Early Prolific	Rotten ..	×	×	×	×	1 : 100	
19	Nut Cut	Bad ..	×	O	×	O	1 : 500	
20	Battlefield	Rotten ..	×	O	×	×	1 : 100	
21	50 (C)	Bad ..	×	O	×	O	1 : 1,000	
22	Indian Early	Rotten ..	×	O	×	×	1 : 1,000	
23	Lambrigg Australian Talavera	Very bad	×	O	×	O	1 : 2,000	
24	Kestrel	Bad ..	×	×	×	×	1 : 2,000	*P. triticina* very scarce (Plots 23–26)
25	Frampton	Very bad	×	O	×	O	1 : 2,000	
26	Yandalin	Very bad	×	O	×	×	1 : 1,000	
28	Early Baart × 3 (A) × Etawah	Very bad	×	O	×	×	1 : 100	
29	141 (A)	Very slight	×	O	×	O	1 : 10	Very little rust
30	*Purple Straw*	*Rotten* ..	×	×	×	×	1 : 100	
31	Farmer's Friend ..	Rotten ..	O	O	×	×	..	Only Summer rust
32	Yandalin	Rotten ..	×	O	×	O	1 : 500	
35	*Hermit*	*Very bad*	×	O	×	×	1 : 50	
36	Kestrel	Moderate	×	O	×	O	1 : 10	
37	*Leakrigg*	*Moderate*	×	O	×	×	1 : 1,000	
39	Aspen	Very bad	×	×	×	×	1 : 100	
40	Smith's Nonpareil ..	Slight ..	×	O	×	O	1 : 1	
41	Steinlee	Very bad	×	×	×	O	1 : 100	
42	Steinwedel × Amethyst × King's Jubilee × Ward's White	Very bad	×	O	×	×	1 : 1,000	
43	Rattling Tom	Very bad	×	×	×	×	1 : 100	
44	Squarehead	Very bad	×	O	×	×	1 : 1,000	
45	Leak's Rust Resistant ..	Moderate	×	O	×	O	1 : 500	
46	Stand Up	Very bad	×	O	×	O	1 : 1,000	
47	Dart's Imperial ..	Very bad	×	O	×	×	1 : 100	
48	Rooney's Rust Resistant	Slight ..	×	×	O	O	..	Very little and only Spring rust
49	Improved Allora Spring	Very bad	×	O	×	×	1 : 100	
50	Rerraf	Very slight	×	O	×	O	10 : 1	
51	Hornblende	Moderate	×	O	×	O	1 : 1	
52	Brodie's Prolific ..	Very bad	×	×	×	×	1 : 100	
54	Dragon	(?) Moderate	×	O	O	O	..	Little, and only Spring rust
55	Jonathan	Slight ..	×	O	×	O	1 : 1	
56	*Allora Spring* × *Yandilla*	*Very bad*	×	O	×	×	1 : 100	
57	Field Marshal × Lambrigg Oustler	Very slight	×	O	×	O	1 : 10	
58	*Early Lambrigg* ..	*Moderate*	×	O	×	O	1 : 50	
59	Carbine	Very slight	×	O	×	O	1 : 2	
60	Eye Bright	(?) Moderate	×	O	×	O	1 : 1	Plant examined, but little rust
61	Field Marshal ..	Very slight	×	O	×	O	1 : 3	Plant examined, only moderately rusted
62	Federation	(?) Very bad	×	O	×	×	1 : 10	
63	Little King	Very bad	×	O	×	O	1 : 100	

TABLE I.—*continued.*

PROPORTION OF SPRING TO SUMMER RUST IN WHEAT PLOTS—*continued.*

Plot.	Variety.	Degree of Rustiness.	Spring Rust.		Summer Rust.		Proportion.	Remarks.
			U.	T.	U.	T.		
64	64 (A) × Hermit ..	Bad ..	×	O	×	×	1 : 100	
65	Dragon × 14 × 193 ..	Slight ..	×	O	O	O	..	Only Spring rust
66	Yandilla	Very bad	×	O	×	O	1 : 100	
67	Wainasso	Very slight	×	O	O	O	..	Only Spring rust
68	Tweed	Very slight	×	O	×	O	5 : 1	
69	Lighthoof	Very slight	×	O	×	O	5 : 1	
70	White Hogan	Bad ..	×	O	×	×	1 : 2,000	
71	Minnesota Blue Stem ..	Practically clean	×	O	O	O	} ..	
72	Power's Fife	Slight ..	×	O	O	O	} ..	Only *P. triticina* observed
73	Duluth	Slight ..	×	×	O	O	} ..	
74	Brodie's Prolific ..	Very bad	×	×	×	×	1 : 100	
75	Langshan	Very bad	×	O	×	×	1 : 100	
75A	M (A) × Field Marshal	Very bad	×	O	×	×	1 : 100	

NOTE I.—Spring rust=*Puccinia triticina*, Erikss.
Summer rust=*Puccinia graminis*, Pers.
U=Uredospores. T=Telutospores.
×=Present. O=Absent.

NOTE II.—The remarks in column "Degree of Rustiness" refer to the condition of the whole plot when examined in the field. At the same time a single plant was taken from each plot and numbered, being afterwards critically and quite independently examined in the laboratory to determine the species of rust. Attention has been drawn to the few instances in which the laboratory results were found not to agree with the field notes when this table was compiled.

THE INJURIOUS RUST IN AUSTRALIA.

From the study of Table I. it will be clear that in Victoria the only rust of economic importance is the Summer rust (*P. graminis*), since where this is absent as in Nos. 16, 48, 54, 65, 67, 71, 72, and 73, no damage has been done. Speaking generally, the less rust present, the greater is the relative proportion of Spring rust, as in Rerraf (50), Tweed (68), and Lighthoof (69). The really rusty wheats, as Queen's Jubilee (1 and 14), Jade (7), and Purple Straw (30), had from one thousand to one hundred thousand times as much Summer rust as Spring rust. Those few instances in which the general proposition is not so strongly in evidence may arise from natural peculiarities in the plants themselves; but rather, I am inclined to think, from the fact that the laboratory work was necessarily confined to one plant, possibly at times hardly representative of the whole plot.

In 1895, sixteen varieties of locally-grown rusted wheat, including the ten Swedish varieties, were sent to Professor Eriksson; and his examination led him to the conclusion that *P. triticina* was more common in Australia than *P. graminis*. The above table furnishes a diametrically opposite result, and is supported by many careful examinations of samples during the last three years. So far as we are concerned in Australia, I am convinced that in years when there is sufficient rust to do any appreciable injury to the crops, that 90 per cent. or over will be found to be *P. graminis*. Possibly the year when the samples received by Professor Eriksson were grown was moist in the early spring, and rather dry afterwards, furnishing conditions favorable to *P. triticina* and adverse to *P. graminis*. This is the only explanation I can see to account for the great divergence noticeable in the results.

B.—Barley Rusts.

The two rusts occurring on the barley in Australia are the Spring rust (*P. simplex*), and the Summer rust (*P. graminis*). In most seasons the Spring rust is by far the more common of the two. This year, however, as shown in the appended table compiled from a critical examination of the experimental plots, the positions were reversed, and indeed it was an exceedingly difficult task in many instances to find the Spring rust at all. The early spring was somewhat dry and evidently unfavorable to *P. simplex*, while during the later part of the season rather moist weather prevailed, evidently favouring the spread of *P. graminis*, though in no case was any material damage sustained.

TABLE II.

PROPORTION OF SPRING TO SUMMER RUST IN BARLEY PLOTS.

Plot.	Variety.	Degree of Rustiness.	Spring Rust.		Summer Rust.		Proportion.
			U.	T.	U.	T.	
87	Prize Prolific ...	Moderate ...	O	O	×	×	...
88	Chevalier Prolific ...	Moderate ...	O	O	×	×	...
89	Hallett's Pedigree ...	Moderate ...	O	O	×	×	...
90	Californian Chevalier ...	Moderate ...	×	×	×	×	1:500
91	Chevalier	Slight ...	O	O	×	O	...
92	Imperial	Moderate ...	O	×	×	×	1:500
93	Italian Battledore ...	Slight ...	×	×	×	O	1:500
95	Chevalier F. ...	Very slight ...	O	O	×	O	...
96	Goldthorpe	Very slight ...	O	O	×	O	...

NOTE.—Spring rust = *P. simplex*.
Summer rust = *P. graminis*.

C.—Oat Rust.

In Australia so far, the Rust of Oats has not been a very serious enemy to the farmer, and only one species has been met with (*P. graminis*). The Wild Oat (*A. fatua*), however, is generally severely affected, and in favoured situations badly rusted plants may be found every month in the year. In the experimental plots very little rust was observed this season, the results being given in the following table :—

TABLE III.

DEGREE OF RUSTINESS IN OAT PLOTS.

Plot No.	Variety.	Degree of Rustiness.	*P. graminis.*	
			U.	T.
76	Golden Oats	... ...	O	O
77	Calutta	Moderate	×	×
78	Winter	... ...	O	O
79	Prize Cluster ...	... ...	O	O
80	Triumph White ...	Slight	×	O
81	Skinless	... ...	O	O
82	Bonanza ...	Slight	×	×
83	Black Tartarian ...	Slight	×	O
84	Algerian	... ...	O	O
85	Newmarket White ...	... ...	O	O
86	French Grey ...	... ...	O	O

In response to an inquiry last year from the Natal Government for seed oats likely to prove resistant to the Crown rust (*P. coronifera*), a sample of Algerians was forwarded, as this variety is under local conditions less severely affected by rust than any other.

Since we in Australia have no Crown rust on oats it will be interesting to see how far the resistance of the Algerian oat to *P. graminis* in one country will prove an indication of its resistance to another rust elsewhere.

General Conclusions.

In contrasting the state of our knowledge of the rust question at the present day with the condition prevailing only ten or twelve years ago, the progress recorded is truly remarkable. Then no definite lines upon which investigations were to be conducted had been laid down. The recognition that in the relative susceptibilities of the different varieties would be found the clue to success in combating the rust was first made in Australia. From that time progress has been slow, perhaps, but nevertheless sure. The complete system of cross-breeding, selection, and testing now being carried out by the Agricultural Departments of New South Wales and Victoria has thus early given convincing proof that we are on the right track. Much still remains to be done, yet there is reason to believe that at no distant date, as a result of this work, varieties of wheat will be obtained suitable to different districts, and resistant to rust.

SPRAYING EXPERIMENTS IN 1901-2 FOR BLACK SPOT *(Fusicladium)*.

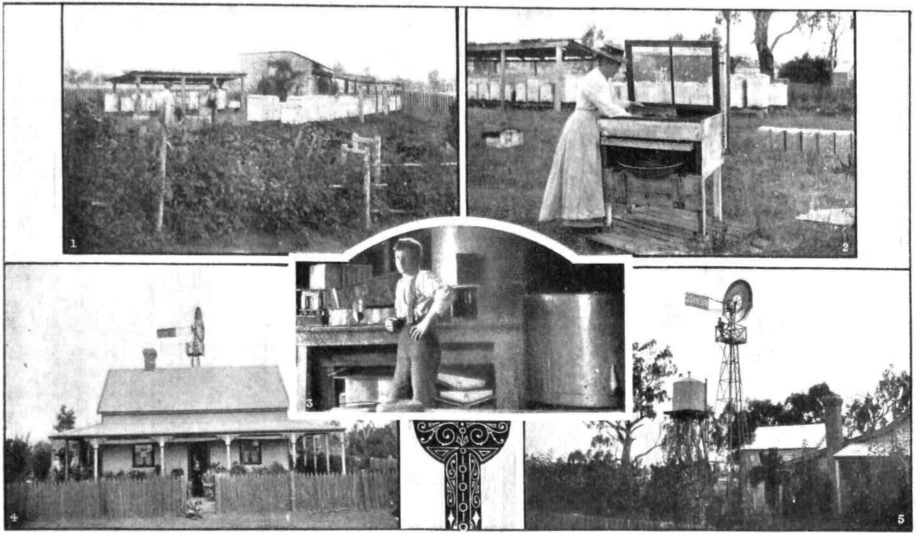
By D. McAlpine.

Experiments in treating "Black Spot" of the apple and pear were conducted by the Department some years ago, and the successful results obtained with the Bordeaux mixture, which consists of lime and bluestone in water, have been published previously. The trials at Pakenham, in 1900–1, were by no means satisfactory, so this season a more extensive series were carried out at three leading fruit centres, Doncaster, Pakenham, and Somerville. Since the spring was particularly favorable for the spread of the fungus, the results are of great practical importance.

It is as yet impossible to reply to the numerous requests which have been made for the results, for the reason that the fruit is not yet ready to be gathered from the experimental plots. To determine the practical value of the various sprays, the fruit from each plot will be sorted into the marketable and unmarketable, and each grade carefully weighed. In this way the percentage of saleable fruit is obtained, and the relative value of the different mixtures fixed. In every case only one spraying was given, and the varieties chosen were specially liable to the "spot." At Pakenham there were eighteen plots of three trees each, of which one plot was left unsprayed to serve as a check and for comparison with those treated. The spraying was done on 19th and 20th September, just as the buds had burst, during showery weather.

As far as present appearances are concerned, excellent results have been obtained in all three localities by using Grant's mixture, the ordinary Bordeaux mixture, and several variations of the latter. The great lesson taught in these experiments is that one thorough spraying at the right time, just as the buds are bursting or have burst, with Grant's mixture or Bordeaux mixture will secure practical immunity from the disease. In no instance will the unsprayed trees yield more than 2 to 5 per cent. of marketable fruit, though the best of the treated plots will probably give about 98 per cent.

It may be stated generally that the addition of a little linseed oil or sal ammoniac to the Bordeaux mixture, or replacing the lime with washing soda (copper-soda or Burgundy mixture) has given very promising results. Full instructions will be given in a future article as to the preparation and application of the most successful sprays used by the Department, and an outline of future proposed experiments, with the object of reducing the cost of the sprays, will be added. Those who neglected to spray this season have, in many cases, met with severe losses, and in some orchards I have visited the ravages of the fungus were so great that the name "fire-blight" had been applied to it. In such cases the fallen leaves and diseased fruit should be burnt in order to lessen the sources of infection. Except in so far as the attacks of the fungus have prevented the production of a good supply of fruit-buds, there is no reason why a fair crop should not be obtainable next season, if the trees are properly sprayed at the right time.



1. Beehives. 2. Extracting Way. 3. Interior of Honey House with Extractor.
4. Mr. Johnson's Cottage. 5. Home-made Windmill.

MR. JOHNSON'S APIARY AT MILAWA.

By H. W. Potts.

It is surprising to find the deep, strong, instinctive affection apiarists develop for their bees, and the absorbing interest they take in this light but fascinating, and withal, profitable avocation. As an adjunct to dairying, or other rural industries, few are better adapted for the occupation of the female branch of the house after the earliest lessons in bee culture have been mastered. In many parts of Victoria, where the native timber with its wealth of blossom has not been ruthlessly destroyed, bee-farming is becoming increasingly popular. During my recent visit to the Milawa district, along the vales of the Ovens and King Rivers, I had the privilege of visiting several well arranged and intelligently conducted bee-farms from which substantial additions to the farmer's income is being earned.

Amongst the most complete in the district is that owned by Mr. W. E. Johnson. It is situated on the south bank of the Tea Garden Creek, about 4 miles to the north of Milawa.

Mr. Johnson and his wife, with the aid of two young sons, took up the establishment of an apiary as a hobby, and it has rapidly developed into a regular avocation and source of wealth without interfering with other work. The house and garden stand on a piece of rising ground overlooking the creek. Along the banks of this permanent stream for several miles, on each slope, are found a variety of native trees, from the blossoms of which the bees collect unlimited supplies of honey. From small beginnings the apiary has increased to 75 hives, all of the Langstroth and Galloper designs, and in some instances supporting three stories of frames. Special care is taken to maintain healthy stock by the annual introduction of well bred Italian Queens. Change of blood, and that of first quality, seems to be the main principle on which success depends. Doubtless to this wise precaution is attributable the healthy condition of the bees, and their conspicuous freedom from invasions and disease. Further, the exclusion of the bee-keeper's scourge the bee-moth is successfully carried out. Here, as in most rural localities throughout the State, sole reliance for food supplies is laid on the blossoms of the native trees, and the periods at which the various species bloom curiously enough seem by nature intended to maintain a continuous food supply throughout the season.

The Red Box (*Eucalyptus Polyonthema*) comes into blossom every year with occasional breaks, but a fairly regular supply may be relied about September, for four or five weeks. A somewhat singular characteristic is observed in the flowering of this tree, the bloom reaches maturity, is well developed in colour and strength, but, secretion of nectar is abnormal, frequently none at all, and the bees have to pass on to other and more profitable species. The next tree to bloom in rotation is the Yellow Box (*Eucalyptus Melliodora*), lasting about six weeks, and extending the bee-food period to November.

Every season brings its own conditions, and these control the wealth or otherwise of the blooms and their secretions. In December, the Red Gum (*Eucalyptus Rostrata*) can generally be relied on to afford luscious supplies of nectar to the toilers until the end of the year. Then the Apple Tree Box for the following six weeks or two months provides a wealth of bloom from which the bees acquire their heaviest stores for the summer months. This season, with all its unaccountable vagaries, has been a bad one for bees. Food has been very short in all the favoured varieties of honey-producing blooms. The Apple Tree Box alone has withstood the drought, and furnished its maximum quantity of bee-food.

The most uncertain honey-producing tree is the White or Grey Box. It blooms in an uncertain way and at various times. It is not an uncommon sight to see the trees covered in blossom in winter, when the bee-food is of no use to the workers. Should the weather prove cold and bleak, then the flowers fail to provide nectar.

The Stringybark Gum tree (*Eucalyptus Eugenoides* and *E. Macrorrhyncha*) come into flower late in the season, but are not to be reckoned as a source of food supply, seeing they only bloom once in three years.

Here, as in other localities, it is found that bees can only work profitably when they have not to travel more than 2 miles from the hive. The certainty of supply is, as a general rule, fairly constant—the trees come into flower in rotation; but a break in the series of good seasons appears, as, for example, this season, when the trees fail to flower and the bee-food is scarce, and naturally there is a substantial falling-off in the returns. The fierce heat of summer never lessens the energy and vigilance of the bees, or their capacity for work in any direction; but quite a different tale is told in wet or windy weather, when these ardent little toilers are perforce compelled to cease labouring. During favorable sunny weather they work unceasingly from dawn until dark. Much, however, depends on the season. Food supplies determine the output. When at their maximum, the hives are robbed in December, and often two extractions are made before the end of the year. In a favorable year, such as last, five extractions were made from 70 hives, with a total yield of 7½ tons. The best season's record Mr. Johnson recalls was when they were enabled to secure 9½ tons from 80 hives. Four tons of this were sent to London, to test that market and relieve the local. It was sent in specially-manufactured tins and cases. The results were disastrous. After deducting all legitimate and other expenses, there was only a return of £15 7s. 9d. Mr. Johnson ascribes these results to bad management and several other technical details, which certainly will act as a stern object-lesson should the export of honey ever be attempted again; and there is no sound reason why some effort should not be made to cater for consumers of this valuable article of food in the open markets of Europe. One fact was specially prominent at the time, and that was the distinct eucalyptus flavour, which was not regarded with favour in London. This season it is not anticipated that more than 2½ tons will be collected from this apiary. All supplies are

now forwarded to purchasers in Melbourne, and the price ranges from 30s. to 35s. cwt. This pays fairly well, and gives the apiarist a satisfactory return. All honey is extracted by an improved honey-extractor. Mr. Johnson is not a trained but a skilled mechanic, self-taught, and he has applied his genius to designing a number of valuable improvements in various ways in the plant used for preparing the honey for market. The honey tank is made to hold about 17 cwt. The extracted honey is treated in a most cleanly manner, and subsequently run into kerosene tins and soldered. The tins and cases are collected in the district from surrounding farmers. They are cleaned thoroughly with a boiling solution of caustic soda, drained, and left out exposed to the sun for several weeks, when they are found to be perfectly wholesome and sweet.

A specially-constructed solar wax-extractor stands in the yard, and exhibits a number of improvements over the ordinary device. It is bee and ant proof, and larger than those in everyday use—2ft. 10in. x 20 inches.

Mr. Johnson points with considerable satisfaction to several records on the hives. The following appears on a three-storied Langstroth:—

Five extractions in one season yielded respectively—

145 lbs.
106 „
84 „
79 „
39 „
—
453 lbs. honey.

On another hive we find an entry dated 6th February, 1899—Extraction, 158 lbs.; and again on 12th March—Extraction, 105 lbs.

An inquiry as to the prevalence of disease elicits the statement—There is no serious trouble, yearly foul-brood does appear, but it is promptly dealt with in a few hives. When the disease has spread generally throughout the hive, then the lot is burnt. In slight attacks the bees are turned out on to a clean foundation.

Mr. Johnson takes unusual care to keep everything scrupulously clean all over the place. Method, neatness, order, and cleanliness are met at every turn.

One of the illustrations shows a well-designed and substantial windmill. This is arranged and built by Mr. Johnson, who in doing so has effected several practical improvements of considerable value.

Here, in the midst of the gum-trees, with splend'd home comforts, Mr. Johnson spends his spare time attending to his bees with a solicitude and knowledge of their habits and characteristics which betokens keen study and natural aptitude.

THE BEET-SUGAR INDUSTRY.

The growth of the beet-sugar industry in the United States during the past ten years is illustrated by the following statement, taken from a recent issue of Willett and Gray's *Statistical Sugar Trade Journal*, giving the quantities of beet sugar produced and the number of factories in operation each year from 1892-3 to 1901-2 :—

Years.	Sugar produced.	Factories operated.
	Tons (2,240 lbs.)	
1901-2	*150,000	39
1900-1	76,859	34
1899-1900	72,944	31
1898-9	32,471	15
1897-8	40,399	9
1896-7	37,536	7
1895-6	29,220	6
1894-5	20,092	5
1893-4	19,550	6
1892-3	12,018	6

* Estimated.

In 1892-3 this industry was carried on only west of the Mississippi, three of the six factories then in operation being located in California, two in Nebraska, and one in Utah. At the taking of the census of 1900, the number of factories in California had increased to eight, in Nebraska to three, and in Utah to four. The industry had, moreover, been taken up with varying degrees of enthusiasm in nine other States; ten factories were in operation in Michigan, making this State, in point of the number of factories, the leading State in the Union; three factories had been established in each of the States of New York and Colorado, and single factories had been erected in Ohio, Illinois, Minnesota, New Mexico, Oregon, and Washington. The capital invested in the industry in 1900 amounted to 20,958,519 dollars.

EXPERIMENTS IN THE PRESERVATION OF EGGS.

The official organ of the Board of Agriculture states that during the past three years some interesting experiments in the preservation of eggs have been carried out by Mr. F. T. Shutt, chemist to the experimental farms of the Canadian Ministry of Agriculture The eggs used in these investigations were quite fresh, being supplied by the poultry department of the Experimental Farm, Ottawa, and taken from the nest within a few hours of being laid. In the experiments of 1898–99 some of the eggs were treated in the first week of October, and tested at the beginning of the following March while a number were retained under experiment until December 1899, a period of fourteen months. The preservatives employed were saturated lime-water; lime-water plus 10 per cent. of common salt 10 per cent. solution of water glass (sodium silicate); 5 per cent glycerine; and distilled water. Some of the eggs were left in the solution for a few days, while others were left in the solutions throughout the entire period of the experiment. The coating of the eggs with paraffin was also tried. After a careful examination of the eggs including poaching, it was concluded that saturated lime-water gave by far the best results.

During the past year several of the above-mentioned trials were repeated. The efficacy of certain other methods for egg preservation that have received attention from time to time in the press, was also tested. The experiment was begun on 5th June, and the eggs examined on 10th December. Three eggs from each experiment were poached.

Briefly stated, the results were as follow :—

1. Eggs immersed continuously in saturated lime-water. Outward appearance excellent; yolks non-adherent, of good colour, and fairly globular; albumen somewhat more limpid than in fresh eggs, and slightly discoloured; a very slight "stale" odour; air space normal poached eggs free from all objectionable taste and of good appearance

2. Eggs first smeared with vaseline and immersed continuously in lime-water. Externally somewhat darker than the foregoing and rathe greasy; yolk globular and of good colour; albumen a very faint yellowish tint and somewhat limpid; a very slight "stale" odour; ai space normal; poached egg very similar to that in 1.

3. Eggs continuously immersed in 2 per cent. silicate of soda. External appearance good, and very similar to that of eggs in lime-water yolk globular and of good colour; albumen but ery slightly discoloured, almost normal; marked odour of a "soapy" character, whicl is further developed in poaching; air space normal; poached egg o very good appearance, but with faint "stale" flavour.

4. Eggs continuously immersed in solution of 5 per cent. of gun arabic and 1 per cent. formalin. Outward appearance inferior to thos in foregoing tests; yolks attached to shell; albumen decidedly discoloured; odour not marked; air space normal; appearance of broke egg much inferior to those in preceding test; developing marked flavou on poaching.

5. Eggs continuously immersed in 5 per cent. gum arabic, plus 5 per cent. salicylic acid. Preserving solution quite mouldy and with a very bad smell. Egg-shells quite soft. The broken egg, though not unsightly, had a most nauseating odour, and was quite unfit for food.

6. Eggs continuously immersed in 5 per cent. dextrin plus 5 per cent. salicylic acid. Preserving solution very mouldy and smelling badly. Egg-shells soft, and contents unfit for food.

7. Eggs dipped momentarily in dilute sulphuric acid, then washed and stored in a large bottle. All exceedingly bad; contents very offensive.

8. Eggs dipped momentarily in sulphuric acid, washed and dipped in alkaline ammonium oxalate, then stored in large bottle. All the eggs very bad, and contents offensive.

These experiments corroborate many of the results obtained in the previous year, and are held to afford further proof of the excellence of the eggs preserved in saturated lime-water. Mr. Shutt thinks that, on the whole, 2 per cent. sodium silicate gives better results than the 10 per cent. solution, but he is also of the opinion that lime-water is superior to both as an egg preservative. "Moreover, it is cheaper and pleasanter to handle."—*Grocer*, London.

CHIEF INSPECTOR OF STOCK'S BRANCH.

REPORT ON THE MORTALITY AMONGST CATTLE IN THE NORTH-EASTERN DISTRICT.

To the Chief Inspector of Stock.

SIR,

I have the honour to report that, in accordance with your instructions, I went to the North-Eastern District on Wednesday morning, 5th March, to inquire into the cause of the present heavy mortality amongst cattle. I was met at the Winton Railway Station by Mr. Gould, who drove me round to the various farms where the cattle had been dying, and I had an opportunity of seeing several in different stages of disease, and had one destroyed for *post-mortem* examination. The history of the present outbreak, together with the symptoms in affected animals and *post-mortem* lesions, I found to be identical with those I have met with in many other districts in this State, and have every reason to believe that a similar mortality reported to me from some of the other States is due to precisely the same causes.

The disease was first brought under my notice about eighteen years ago, and before dealing with the causes, symptoms, and treatment, I would like to point out certain characteristics.

Ever since its inception it has continued to claim an increasing number of victims, and to extend to districts where it was previously unknown. This increasing prevalence has been more especially noticeable since dairying came into prominence. It is mainly, though not exclusively, confined to milking and in calf cows, and usually those in poor condition. There are, however, instances of cattle in apparently good condition becoming affected.

The disease occurs at all seasons of the year, but chiefly during the later summer months, especially in dry seasons or after a succession of such seasons.

It is found only in districts where the soil is poor, more especially in sandy, heathy, or granite soils, and is invariably associated with the bone-chewing habit and so-called cripples. The disease is non-infective and non-febrile, and the mortality among affected animals may be roughly estimated at about 75 per cent.

Symptoms.

The duration and symptoms vary considerably. In some cases the attack is sudden, and death may take place within 24 hours; in other cases it comes on gradually, and the patient may linger for a fortnight or three weeks, and occasionally the animal gradually recovers. The more pronounced symptoms are loss of milk suspended rumination, and inability to masticate or swallow; although the appetite may remain good the animal cannot gather the food or retain it in the mouth. The lower jaw hangs down, the tongue protrudes, and saliva dribbles from the mouth. The back becomes arched

and the hair rough, and there is a disinclination to move. The gait is stiff, and there is sometimes an involuntary escape of urine. The bowels remain normal for some time, but in some cases the contents of the rumen and omasum become dry, and the gall bladder full, owing to suspended rumination and inability to swallow.

Occasionally false rumination may be observed when the lower jaw is seen moving, but when examined closely it will be noticed that there is no food in the mouth, and that the teeth do not come together, and that neither regurgitations nor swallowing. The coats of the rumen, like the muscles of diglutition, are paralyzed. In some cases there is sudden general paralysis when the animal becomes prostrated, and lies on its side quite unable to rise or move. The eye loses sensibility to light and to the touch, and death takes place in a few hours. This form most frequently occurs in heavy milking cows.

Post-mortem Appearances.

In all cases where affected animals have died without having been subjected to treatment, there is an absence of any serious pathological changes that would enable one to state the actual cause of death, except that in the majority of instances there is an excessive amount of arachnoid fluid, and the blood looks somewhat thick and less in quantity than usual. Other morbid changes are frequently found, but these can readily be accounted for by the suspension of the digestive functions, and are only secondary.

On the other hand, in all cases where animals have been treated (*drenched*) after paralysis of the muscles of deglutition had set in, I have invariably found the contents of the drench, whether consisting of medicine or gruel, in the trachea and bronchial tubes, and in nine cases out of ten death is due to this cause. In some cases the animal dies from suffocation while being drenched or shortly afterwards, and the medicine in some cases has been erroneously blamed for poisoning them. In others broncho-pneumonia is set up, and one or two days may elapse before death takes place.

Instances have occurred where affected animals have recovered without treatment, and others that have had a laxative drench administered, while still able to swallow, often recover in a few days.

Causes.

The fact that the disease is invariably confined to districts where the soil is poor or exhausted, and the herbage innutritious, and that it has continued to claim a larger number of victims every year, and that it is associated with the bone-chewing habit and cripples, points directly to soil exhaustion as the primary cause. None of the popular theories, such as plant poisoning, eating poisoned rabbits, or picking up poisoned wheat, &c., would in any way account for the number of deaths that have taken place this season, which in the aggregate must amount to some thousands. It is difficult to get laymen to understand how an animal apparently in fair condition may yet die from starvation, not general starvation, but bone

or nerve starvation. Some will tell you that their cows get the disease all the same, whether fed on chaff or left to forage for themselves, but they forget that the chaff itself has been grown on the same impoverished soil, and consequently lacks the necessary elements of nutrition.

The lack of phosphates and other important soil constituents gives rise to several forms of disease, and their evolution is interesting. The first indication of soil exhaustion is the bone-chewing habit in cattle, and wool-eating in sheep. The next stage the so-called cripples, and finally the paralytic form just described ; many sheep are dying from the latter in the North-Eastern District at the present time. Bone-chewing is accountable for many more deaths than is generally believed ; eating dead rabbits, while not likely to often result in phosphorous poisoning, may cause death through septicæmia, while chewing the bones of larger animals often causes death from choking as well as blood poisoning, and death is in many instances brought on by the bones becoming wedged in the teeth or jaws so as to prevent the animal eating. The symptoms in such cases are as various as the causes, hence the different opinions and confusion, yet they may all be traced to soil exhaustion as their primary cause.

Remedies.

Various remedies such as feeding, bone-meal, molasses, linseed oil have been tried with varying degrees of success. Whilst medicines, such as phosphate of lime, salts of iron, potassium, as well as rock salt, and common salt, have been given with certain amount of benefit. None of these, however, can be expected to do more than minimize the mortality and tide over an outbreak.

Something more is wanted, and sooner or later stock-owners will be compelled to modify the whole system of farming. For upwards of 50 years the land, never very rich, has been robbed of its annual crop of beef, mutton, dairy produce, or cereals, as the case may be, and nature is now crying out against this with a voice that will compel attention.

If the rich English or Danish pastures were left without fertilizers for ten years they would no longer be able to carry stock. The fact is stock-owners have far more land than they can manage, and in many cases it would be wise to sell the half or more and put all the money into improving the remainder in the way of purchasing fertilizers and growing forage crops.

I have the honour to be,

Sir,

Your most obedient servant,

(Sgd.) W. T. KENDALL, M.R.C.V.S.

Melbourne Veterinary College,

11th March, 1902.

N.B.—An examination of blood, cerebro-spinal fluid, spinal cord, and internal organs by Dr. Cherry, at the Bacteriological Laboratory of the Melbourne University, and taken from the affected animals, showed them all to be sterile, no organisms whatever developing in the culture tubes and plates.

Report on Analysis of Soils.

Agricultural Laboratory,
440 Lonsdale-street, Melbourne, 15th February, 1902.

SAMPLES FORWARDED BY MR. W. H. GOULD, WINTON, IN CONNEXION WITH INQUIRY INTO CAUSE OF DEATH OF CATTLE AT WINTON.

The samples on analysis were found to contain—

Soil.	Nitrogen.	Phosphoric Acid.	Potash.	Lime.	Chlorine.
	Parts in 100,000.				
Sample taken from Paddock No. 1	97	32	192	240	3
,, ,, ,, ,, 2	89	37	290	214	3
	Not less than				Not more than
It may be considered that a first-class soil should contain ...	250	150	200	400	35

The soil, as indicated by analysis, is a poor one. Phosphoric acid, as in the case of nearly all our northern soils, stands out as the most prominent deficiency, while the percentage of nitrogen is low, and the lime little more than half the requirements of a good soil.

There is no doubt that such a soil would respond well to artificial manures, especially the phosphatic. The nature and composition of the vegetation of such soils would be influenced by these deficiencies, and its nutritive quality affected. The great quantity of potash salts, which is a feature common to nearly all our northern soils, might in presence of the relatively small quantities of chloride of sodium (salt) have important bearings on the health of the beast. Physiological inquiries have shown that the "herbivora can do well on a diet in which the relation is from four to six equivalents of potassium to one of sodium." A much greater quantity of potassium than this would create the desire and necessity for sodium, and there is every reason to think that free access to salt, especially in our northern areas, is indispensable to the healthy condition of all classes of stock. Investigations on the nutritive value of the herbage of our pastures have not yet been undertaken in Victoria, but when provision is made in this laboratory by the necessary increase of staff for a systematic analysis of our grasses, &c., there is little doubt that information of a valuable nature will be available on this and many other points.

The innutritious nature, as revealed by analysis, of most of the samples of vegetation sent me in conjunction with the apparently polluted water supply, as shown by recent analysis, is not calculated to keep a beast in a healthy condition, and would certainly intensify susceptibility to disease. While not perhaps bearing specially on the present case, I feel sure that the application of phosphatic manures to our pastures, a free allowance of salt, and a greater attention to the purity of the water supply, will do away with a lot of the different troubles affecting our herds.

FRED. JNO. HOWELL,
Chemist for Agriculture.

Report on Analysis of Water from Winton.

Agricultural Laboratory,
440 Lonsdale-street, Melbourne, 20th January, 1902.

Sample No. 9489.

FORWARDED THROUGH CHIEF INSPECTOR OF STOCK, BY MR. WILLIAM HENRY GOULD, WINTON, IN CONNEXION WITH INQUIRY INTO DEATH OF STOCK.

The sample on analysis was found to contain—

	Parts in 100,000.
Total solids dried at 150 ...	80·80
,, Ignited ...	65·80
Chlorine ...	3·10
Nitrogen, Albumenoid ...	·2974
,, Ammoniacal ...	·0091
,, as Nitrates and Nitrites ...	·012

The sample was tested for the commoner mineral poisons with negative results. The prominent feature in the water, as indicated by the analysis, is the great amount of organic matter present—the Albumenoid Nitrogen exceeding by more than 25 times the limit allowed in a good house water. A water containing so much organic matter, especially if of animal origin, could not be considered as an advisable one even for stock, although in the case of contamination from vegetable products cattle sometimes show a great resistance to ill effects. Such a water might be injurious from the presence of certain products of decomposition, and it has been found occasionally that waters so charged with organic matter are able to create true symptoms of poisoning, as well as induce diarrhœa and anthracoid, and putrid diseases. If the cattle confined to this water are the only ones so affected in this district, there would be reasons for suspecting this as a possible cause; but the information furnished me on the whole matter is very limited. If the water is the trouble, the symptoms and *post mortem* ought to give indications of this. The *post mortem* "would reveal a general anæmic condition with broncho-pneumonia, and perhaps some degree of congestion of the gastro-intestinal mucous membrane. As a rule, however, the lung lesions are, in chronic cases, more pronounced than those in the digestive tract. In some instances, and when the source of contamination is abundant, the animals may rapidly succumb to gastro-enteritis with colliquative and fœtid diarrhœa, great prostration, high fever (106·7 F.), and other signs of putrid intoxication."

FRED. JNO. HOWELL,
Chemist for Agriculture. &c.

REPORT ON A DISEASE IN PIGS IN GIPPSLAND.

To J. R. Weir, Esq., Acting Chief Inspector of Stock, Melbourne.

SIR,

I have the honour to report in reference to the pig epidemic at Orbost, that I went to Orbost to inquire into the matter. Mr. Perry, the secretary of the Agricultural Society there, referred me to Mr. James Cameron, the president. He gave me all the assistance he could. There seemed to be at least three distinct complaints prevalent amongst the pigs, all causing more or less losses. The most serious seems to be a lung complaint, locally known as the heaves or pants, and is most prevalent in pigs from six weeks to four months old, often carrying off a whole litter soon after they are weaned.

The first symptoms are a falling in of the sides, and a panting or heaving in the breath ; later on a cough develops, and in most cases the animal dies in a short time.

Post-mortem Appearances.—In the early stages the lung turns a pale colour, and later on gets a mottled appearance, light, and darker in patches. On cutting into the lung a frothy, pale-coloured liquid exudes, the lung seems to decompose, and is brittle and easily broken up with the finger and thumb. In most cases adheres to the ribs, and in the four subjects examined both lungs were affected. (In cases where the animal recovers, and is fattened and killed, the lungs are found adhering to the inside of the chest.) There is a frothy discharge from the mouth during the continuance of the disease. Worms were present in one of the subjects examined, two samples forwarded being taken from the small intestines. I am forwarding half a lung from two of the pigs killed. I had to preserve these specimens in spirits, as, owing to the hot weather and the distance from Melbourne, they would not keep in any other way.

This disease is not confined to Gippsland, and subjects may be found every now and then in the Melbourne pig markets.

The pig breeding and fattening industry is conducted on a pretty large scale at Orbost, between five and six thousand pigs being sent annually to Melbourne.

The second disease is an affection of the eye. It starts with a watery discharge from the lid, which gradually closes up, and in pulling the lids asunder the eye is found completely destroyed. The discharge eats into the flesh about the eye, and in most cases the animal dies. It mostly attacks young pigs from six weeks to two months old. I could not obtain a sample of a pig in an advanced stage of the disease, but Mr. J. Gilbert, from whom I got the sample (two eyes taken from a pig developing the disease), tells me that he has lost about 30 pigs from this complaint, and knows the symptoms at once. The pig killed and examined seemed otherwise healthy, lungs, liver, and intestines showing no signs of disease.

The third disease complained of by Mr. Cameron is not very common, and I was unable to obtain a subject to examine. It is described as appearing at first in the shape of a small enlarged spot just below the eyes, and, as it develops, a hole appears, which gradually eats into the head, and kills the pig. Mr. Cameron informs me that he sent a head of a pig suffering from this disease down by Mr. Wilson, the Government Spayer, some time back, and that Dr. Cherry seemed to think it was caused by an accident, but as it occurs so often it is evidently some disease. Mr. Cameron will endeavour to obtain a sample, and forward it down.

In conclusion, I think these diseases are caused in a great measure by the way the pigs are kept, and the remedy lies a great deal with the farmers themselves. Pig breeding and fattening has been carried on for a number of years at Orbost. Large numbers of pigs are kept in small enclosures, the land being too valuable on the flats to allow them much room. In many cases, from one to two hundred pigs are kept on these small patches, which have been used for the same purpose for years, diseased pigs being allowed to run among the herd until they die, and then being buried on the spot, or in many cases allowed to rot where they die. In the majority of cases there is a large barn or maize shed built on piles from 2 to 4 feet above the surface. In case of floods the open space under these sheds is the camping ground for the pigs, summer and winter. They are never cleaned out, and there is an accumulation of fine dust and pig manure a foot or more in depth. In addition to this, these places are open all round, and very cold draughts blow through them when there is a change in the weather, and I should think is liable to cause lung troubles.

This disease caused some losses on the Lindenow flats a few years ago, and, although not completely stamped out, is not often seen there now. The steps taken there were to pull down all old sties, and plough the land up, and use it for other purposes, building new sties in fresh situations, and giving a fair-sized grass run, great care in purchasing pigs, and at once destroying and burning any animal showing any signs of disease.

I have the honour to be,
Sir,
Your obedient servant,
H. R. MACKENZIE,
Inspector of Stock.

Report by Dr. Cherry, Lecturer in Bacteriology, Melbourne University.

15th January, 1902.

SIR,

In reference to the specimens of the pigs forwarded from Gippsland last month, I find that the lungs are affected with tuberculosis. This disease is most frequently communicated to young pigs by means of the milk on which they are fed.

The ulcerations about the eyes and neighbouring parts of the face are due to septic organisms, which obtain entrance probably through slight scratches and other injuries. They are likely to be communicated to fresh pigs, when a number are feeding together, and the yards or sties are also likely to become infected.

The chief measures to stop the disease in pigs are—for tubercle, to boil all food; and for the ulcerations, to change the pig runs, put them into fresh paddocks, and cultivate the old ones.

I have the honour to be,
Sir,
Your obedient servant,
THOMAS CHERRY.

The Chief Inspector of Stock.

Returns of Stock introduced at Border Crossings for Year ending December, 1901.

Crossing.	Horses.	Cattle.	Sheep.	Pigs.
Apsley	12	20	7,944	...
Buchan	354	164	...	...
Cobram	50	197	14,906	7
Dartmoor	17	...	131	...
Delegate	62	1,764	4,461	70
Echuca	381	7,201	283,068	425
Gooramadda	338	792	58,450	55
Jingellic	156	812	694	...
Koondrook	1	915	65,320	36
Lockhart	1,531	1,224	11,694	646
Mildura	16	55	26,710	...
Narung	40	...	14,889	...
Nelson	3	8	2	...
Penola	128	100	9,216	...
Strathdownie	167	329	7,038	...
Swan Hill	69	2,641	90,826	...
Tintaldra	470	4,523	10,621	19
Tocumwal	163	6,753	102,519	103
Wahgunyah	45	2,100	51,643	1
Wodonga	8,276	14,070	359,267	3
Yarrawonga	486	2,076	83,796	669
Total	12,765	45,804	1,203,195	1,934

Statement of all Cattle Inspected, and Diseases found amongst them during the year ending 31st December, 1901, by the undermentioned District Inspectors :—

Name of Inspector.	District.	No. of Cattle Inspected.	Diseases.			No. of Cattle Killed.	No. of Cattle Isolated.
			Pleuro-pneumonia.	Tuber-culosis.	Other.		
H. R. Mackenzie	North Gippsland	69,433	14	6	6	26	...
J. R. Weir ...	South Gippsland	25,022	6	32	52	65	350
W. J. Cother ...	Geelong ...	37,569	54	18	38	72	40
Wm. Haines ...	Warrnambool ...	50,323	11	32	11	40	10
C. Lawler ...	Central and other	50,131	9	63	18	78	78
Various inspectors	Melbourne ...	52,964	11	34	21	66	145
		285,442	105	185	146	347	623

EXPORTS BRANCH.

PRICES AND STATISTICS.

By R. Crowe.

STATEMENT showing Quantities and Average Prices for best quality of Butter exported to Great Britain from Victoria for corresponding periods in the busiest part of the last three seasons.

Shipped for Week ended		1901–2.			1900–01.			1899–1900.		
		Quantity.	Price.		Quantity.	Price.		Quantity.	Price.	
		cwt.	s.	d.	cwt.	s.	d.	cwt.	s.	d.
Oroya,	Sept. 17 ...	1,561	120	0	5,180½	112	9	3,642	105	5
Himalaya,	" 24 ...	1,774½	115	2	5,696½	109	0	9,708	101	8
Ormuz,	Oct. 1 ...	3,103½	113	10	6,481½	107	1	8,877	102	7
China,	" 8 ...	3,175½	113	10	9,278½	108	0	11,049	104	4
Oruba,	" 15 ...	3,107	113	3	4,777	111	9	11,272½	105	1
Arcadia,	" 22 ...	10,092	110	6	11,790½	111	9	11,902½	104	9
Austral,	" 29 ...	8,694	106	8	11,658	111	6	13,658	104	8
India,	Nov. 5 ...	9,807	106	4	12,064	110	2	13,795½	101	7
Cuzco,	" 12 ...	5,037	105	8	16,780½	111	4	12,400	101	0
Oceana,	" 19 ...	12,370	106	4	16,047	108	6	9,415	100	0
Omrah,	" 26 ...	11,992½	108	0	12,044	113	0	11,313	98	2
Britannia,	Dec. 3 ...	9,461	106	9	10,853½	112	0	8,224½	97	2
Ortona,	" 10 ...	8,880	108	0	12,103	108	4	15,956½	96	10
Australia,	" 17 ...	8,020	108	6	11,115	108	2	18,600	100	4
Orizaba,	" 24 ...	6,480	109	3	9,210½	108	7	10,547½	100	8
Victoria,	" 31 ...	4,980	111	6	7,013½	110	0	13,795	98	0
Oroya,	Jan. 7 ...	4,003	112	0	2,406½	107	6	4,874	100	0
Rome,	" 14 ...	1,736½	112	0	4,896½	104	0	11,282	97	0
Ormuz,	" 21 ...	634	112	0	16,106	104	0	5,834	96	0
—	" 28 ...	...	...		5,767½	106	0	4,853	93	4
—	Feb. 4 ...	...	...		4,366½	104	0	3,790	93	4
—	" 11 ...	...	...		2,907	104	0	4,263½	92	6

The above figures are the average of half-a-dozen best Western District factories salted butter.

The prices are published with a view to enable factory companies to make a comparison with their own returns.

In the case of all those who secure lower prices, the extent to which they may improve their returns by attaining a name for uniformity, and a high standard of quality, will be seen.

Butter factory managers and directors usually attribute low prices to injustice on somebody's part rather than the true cause.

My experience has been that, if the quality is maintained at the very highest level, best prices cannot be denied.

Those figures are intended solely as a stimulus to those who have secured lower prices. Nowadays, when milk first drawn from cows near the Murray, in Gippsland, or anywhere else in Victoria, is just as suitable for making butter of the very highest quality as that of the Western District. As a matter of fact, evidence of such exists in every part of the State, and wherever such is found the prices are invariably good.

PARTICULARS of Frozen Produce exported from Victoria from 20th February, 1902, to 20th March, 1902.

Description of Produce.		Shipped through Government Cool Stores.	Shipped through other Cool Stores.	Total Quantity Shipped.
Butter (Victorian)	lbs.	165,704	290,900	534,444
,, (Inter-State and Bond) ...	,,	72,240	5,600	
Cheese	,,	...	9,120	9,120
Milk and Cream (Concentrated) ...	cases	993	25	1,018
Poultry	head	7,362	6,135	13,497
Eggs	dozen	9,720	216	9,936
Lamb and Mutton	carcasses	9,883	10,970	20,853
Calves and Pigs	,,	144	...	144
Beef	qrs.	...	355	355
Rabbits	pairs	225,800	22,584	248,384
Hares	,,	8	...	8
Game	head	1,183	...	1,183
Sundries	pounds	2,975	3,550	6,525
Fruit and Fruit Pulp	cases	4,380	9,630	14,010

RABBIT EXPORT TRADE.

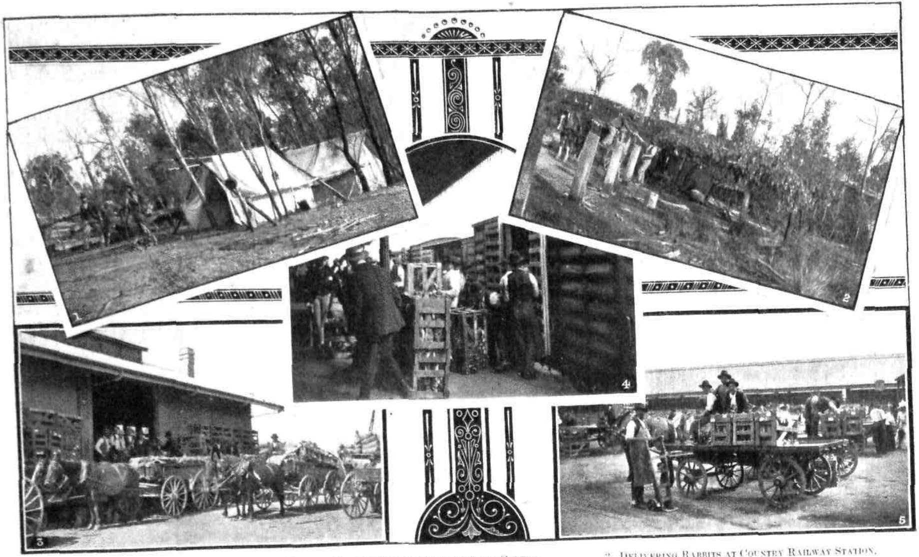
By R. Crowe.

Early in 1894 a few trial shipments of rabbits were made to England, which proved a success. Since that time the export trade in rabbit flesh has grown enormously. It is estimated that, for the season before last, the total of frozen rabbits shipped from Australasia was equivalent to 750,000 sheep of average size. For last season 2,271,210 pairs of frozen rabbits, together with 1,699,655 lbs. of preserved rabbits, were exported from Victoria.

It is very questionable whether any country should be proud of having such a class of stock trenching on valuable pastures. There can be no doubt but that the grass could be diverted into many more desirable channels. However, since the rabbits exist in such large numbers, and are so difficult to keep in check, there appears to be every justification for turning them to profitable account. Many a land-owner has cause to look upon the rabbit pest as one of the worst curses that could befall him. The expense of combating the evil has wrecked scores of men who, were it not for this adversity, would now be in affluent circumstances. On the other hand, hundreds of working men have been able to make a comfortable living by trapping, and assisting to keep them in check, and the masses of Britain have been supplied with a delicate and cheap food.

When the export trade first began, trappers found ample employment in close proximity to Melbourne, whilst now they have to go away into the back country to find rabbits in sufficient quantities to enable them to earn a decent living. There are over 1,000 men camped out in summer time trapping rodents for export. Their camps (see Plate I.) may be met with in all parts of the State. The method of operation is to set the traps in the evening, and after nightfall to make a visit to each one. The rabbits caught in the meantime are taken out and cleaned, and the traps set afresh. A second round is made about midnight, whilst a third visit is paid at daybreak. The animals are suspended on sticks in pairs, under shade to cool, and a hessian cover is drawn over them to keep off the flies. The carter, when ready, conveys them to the nearest railway station, where they are sold directly to agents, or consigned to packers and exporters at the various freezing works. For transit by rail, they are suspended on sticks in crates, and carried in louvre cars, chiefly by passenger trains. On arrival at Melbourne no time is lost in having them conveyed on lorries to the Government cool stores, where the purchasers check the numbers, and present them to the Government graders for examination.

The graders examine each and every animal, and pass those only that are in best condition, and up to the proper weight for export. There are usually two grades in furred rabbits, but for a short period during the season a third grade is included, namely (1) 24 large rabbits weighing over 60 lbs. net; (2) 24 young rabbits weighing over 48 lbs. net; and (3) 28 small rabbits. In addition, another class,



1. Rabbit Trappers' Camp. 2. Trapped Rabbits Hung at Road-side for Carter. 3. Delivering Rabbits at Country Railway Station. 4. Unloading Trucks at Spencer-street. 5. Carting Rabbits to Government Cool Stores.

made up of rabbits in sound condition, but lacking weight, is put up as "skinners." All other rabbits are rejected, and any that are unfit for human consumption are despatched to desiccators to be converted into manure. Rodents that are rejected for poorness of condition, being aged, deficiency in size, and like faults, are disposed of locally by the owners. Those that come by their death, other than by trapping, are at once discarded. The rabbits passed as suitable for export are packed in crates, and at intervals of every twenty minutes the chilling chamber is opened, and the animals thus packed are placed inside. A large chamber is set apart daily for the chilling of each day's intake. In the busy season of the year two chambers are required, which hold up to 1,500 or 1,600 crates. These chambers are left sealed up until the rabbits are hard frozen, and fit for stacking in freezing chamber ready for shipment. This operation usually takes from three to four days. When a boat arrives the crates are loaded into insulated trucks, which come up to the doors of the freezing chambers. When loading is completed the trucks are sealed, and sent to the pier for shipment.

EXPORT OF FRUIT.

By C. French.

Return of Fruit Inspected for Export to England and ports beyond the Australian Commonwealth, for season to date, 20th March, 1902 :—

England—
Apples ... 25,099 cases
Pears ... 383 ,,
Grapes ... 575 ,,
South Africa—
Apples ... 1,213 ,,
Pears ... 26 ,,

Colombo—
Apples ... 748 cases
Pears ... 10 ,,
Grapes ... 26 ,,
Peaches ... 56 ,,
Plums ... 130 ,,
Quinces ... 12 ,,

Bombay—
Apples ... 410 cases
Singapore—
Apples ... 200 ,,
Madras—
Apples ... 73 ,,

Return showing number of cases of Fruit, Plants, and Bulbs inspected for export to Australian States, and New Zealand only, for month ending 20th March, 1902 :—

Name of Fruit, &c.	Number of Cases Inspected.	Number of Certificates Given.
Apples	2,104	76
Apricots	35	6
Bananas	1,518	254
Black Currants	2	2
Cucumbers	5	5
Figs	395	10
Grapes	1,854	224
Lemons	927	67
Melons	2	2
Nectarines	32	24
Oranges	234	49
Passion Fruit	19	12
Peaches	1,328	259
Pears	9,270	182
Pine Apples	123	69
Plums	2,493	65
Quinces	47	14
Raspberries	4	4
Tomatoes	120	13
Plants	9	7
Bulbs	8	8
Total	20,529	1,352

EXPORT OF FARM PRODUCE.

By J. Knight.

The shipment of fodder to order of the Army Service Corps has been pushed on with vigour by the contractors, and the amount of hay and oats contracted for has now been shipped by them.

The attached statement shows the amount shipped from this State for the first three months of this season, and that of 1901.

No further contracts have been let, and it is stated that the price of hay precludes shippers from offering at prices which can be accepted by war authorities, as other markets are much more favorable.

In consequence of our market being unfavorable, oats are now being shipped from New Zealand, the contractors having the right to supply from any of the States, or New Zealand.

FORAGE SHIPPED TO SOUTH AFRICA DURING JANUARY, FEBRUARY, AND MARCH, 1901-2. ACCOUNT WAR OFFICE.

Products.	During 1901. Shipped.				Products.	During 1902. Shipped.			
	Tons.	cwt.	qr.	lbs.		Tons.	cwt.	qr.	lbs.
Hay	14,610	0	0	0	Hay ...	40,908	14	2	21
Balance of contracts let, to be shipped March					...	2,000	0	0	0
Oats	15,236	0	0	0	Oats ...	20,576	15	0	0
Chaff	Nil	...	...	...	Chaff ...	1,075	18	0	0
Flour	2,171	0	0	0	Flour ...	1,500	0	0	0

Products.	Increase During 1902.				Products.	Decrease During 1902.			
	Tons.	cwt.	qr.	lbs.		Tons.	cwt.	qr.	lbs.
Hay	28,298	14	2	21	Hay ...	Nil	...	...	...
Oats	5,340	15	0	0	Oats ...	Nil	...	...	...
Chaff	1,075	18	0	0	Chaff ...	Nil	...	...	...
Flour	Nil	...	...	...	Flour ...	670	18	0	0

NOTE.—A large portion of the contracts let in this State for oats is being shipped from New Zealand, and no record of it is kept in this office. The amount shown in the above is for produce shipped from this State only.

Monthly Return of Farm Produce Exported and Certified to, 21st February to 21st March, 1902.

South Africa ...	... 422,050 bales Hay	...	On account of War Office.
,, ,, ...	... 49,000 bags Oats	...	,, ,, ,,
,, ,, ...	... 5,704 bales Chaff	...	,, ,, ,,
New South Wales	... 1,418 bags Potatoes	...	Private Shipment.
,, ,,	... 1,199 bags Onions	...	,, ,,
,, ,,	.. 500 c/s Potatoes	...	,, ,,
,, ,,	.. 2 bags Carrots	...	,, ,,
Queensland ...	... 295 bags Onions	...	,, ,,
,, ...	... 386 bags Potatoes	...	,, ,,
,, ...	... 30 c/s Potatoes	...	,, ,,
Western Australia	... 250 bags Potatoes	...	,, ,,
,, ,,	... 314 bags Onions	...	,, ,,
,, ,,	... 5 bags Peas	...	,, ,,
,, ,,	... 150 bags Seed Oats	..	,, ,,
South Africa ...	.. 355 bags Onions	...	,, ,,
,, ,, ...	... 500 c/s Onions	..	,, ,,
,, ,, ...	... 1,000 bags Seed Oats	...	,, ,,
Manila ...	... 207 bales Hay	...	,, ,,

REPORT ON THE IMPORTS OF BUTTER, CHEESE, AND BACON INTO THE UNITED KINGDOM FOR 1901.

By J. M. Sinclair.

The total quantity of butter imported into the United Kingdom for the year ending the 31st December, 1901, amounted to 185,140 tons, valued at £19,297,005, against 168,925 tons, valued at £17,450,435, for 1900. This shows an increase of 16,214 tons over the latter year. A statement may be given showing the value of butter imported from each of the principal butter exporting countries during 1900 and 1901 :—

	1900.	1901.
Denmark	£8,029,625	£8,950,497
France	1,785,504	1,704,128
Russia	980,770	1,655,352
Holland	1,414,441	1,511,564
Canada	640,760	1,008,002
Sweden	1,013,775	938,889
Victoria	1,296,438	921,505
New Zealand... ...	784,054	819,534
United States ...	277,724	689,164
New South Wales ...	394,415	293,117
Germany	190,820	150,206
Queensland	7,630	200
Other countries ...	664,479	653,987
Total ...	£17,450,435	£19,297,005

These figures show that Denmark increased her exports of butter to the United Kingdom in 1901 to the extent of £920,872 worth, this increase representing nearly the total value of imports from Victoria for the same period, which amounted to £921,505. Victoria, from occupying in 1900 fourth position in supply of butter, was only seventh in 1901. The value of Russian butter (chiefly Siberian) showed an increase of £674,582 for the past year over 1900. The Canadian increase amounts to £367,242 over the previous year. The decrease in the value of Victorian butter imported into the United Kingdom for 1901 against 1900 is given at £374,933, the larger portion of which could, no doubt, have been provided for if stock had been fed in the same manner as in other dairying countries.

Cheese.—The total quantity of cheese imported into the United Kingdom for 1901 amounted to 129,344 tons, valued at £6,227,277. Of this quantity Canada supplied 77,388 tons, valued at £3,697,780, the United States following with 27,005 tons, valued at £1,274,061.

Bacon.—During the past year of 1901 there were 288,617 tons of bacon imported, valued at £13,590,176. The United States supplied 212,216 tons, valued at £9,255,851 ; and Denmark 53,045 tons, to the value of £3,234,456.

A PNEUMATIC GRAIN ELEVATOR.

A pneumatic grain elevator, built to the order of the London Grain Elevator Company Ltd., 108 Fenchurch-street, E.C., has been launched. This pneumatic system of discharging grain in bulk from steamers direct to barges is known as Duckham's patent, and the quantity to be discharged is 100 tons per hour. In this elevator there is no stive room, but it is fitted with Haviland-Farmers patent air purifier. The weighing of the grain is automatically done, and thereby a great saving in labour is effected. The dimensions of the floating barge are 60 ft. by 25 ft. by 18 ft. The machinery for discharging the grain is of 500 horse-power, steam being supplied by a large boiler working at 140 lbs. pressure. The elevator is fitted with electric light, steam capstan, and all other necessary appliances for shifting in the docks at London, where it is to be stationed.—*The Miller.*

RAINFALL IN VICTORIA.

MONTH OF FEBRUARY, 1902.

Areas.	Actual Average Rainfall recorded in each Area, in February, 1902.	Average Rainfall for each Area for the Month of February, based on all previous years of record.	Maximum Fall recorded within each Area during February, 1902.
	Inches.	Inches.	Inches.
A	0·06	0·20	0·19 at Hopetoun
B	0·35	0·27	1·16 〃 Apsley
C	1·28	0·59	1·81 〃 Panmure
D	2·72	0·85	3·26 〃 Port Campbell
E	0·06	0·51	0·15 〃 Charlton
F	0·15	1·07	0·50 〃 Tungamah
F1	0·47	0·94	0·75 〃 Yea
F2	0·30	2·06	0·65 〃 Wodonga
G	0·61	0·64	0·95 〃 Clunes
H	0·72	1·14	1·33 〃 Daylesford
I	1·07	0·99	1·44 〃 Grantville
I1	1·61	1·31	1·95 〃 Lilydale
K	1·58	1·89	3·00 〃 Warburton
L	1·11	1·84	1·77 〃 Moe
M	0·36	3·32	0·36 〃 Gabo

Subdivisional Areas of the State of Victoria, representing typical Distribution of Rainfall.

A. North-west—Mallee country, including the counties of Millewa, Taila, Weeah, and Karkarooc.

B. Central West—Including the counties of Lowan and Borung.

C. Western Districts—Including the counties of Follett, Dundas, western half of Ripon and Hampden.

D. South-western Districts and West Coast—Including the counties of Normanby, Villiers, Heytesbury, and Polwarth.

E. Northern Country.—Including the counties of Tatchera and Gunbower, and the northern half of Kara Kara, Gladstone, and Bendigo, and the north-west portions of Rodney and Moira.

F. Northern Country—Including the greater part of the county of Moira, the north-eastern quarter of the county of Rodney, and the extreme north-west of the county of Bogong.

F1. Central North—Including the county of Anglesey, the west and northern parts of the county of Delatite, the extreme south of the county of Moira, and the south-east quarter of Rodney.

F2. Upper Murray—Districts from Wodonga to Towong.

G. Central Districts North of Dividing Ranges—Including counties of Talbot and Dalhousie, southern half of the counties of Kara Kara, Gladstone, and Bendigo, and the south-west quarter of the county of Rodney.

H. Central Highlands and Ranges from Ararat to Kilmore.

I. South Central Districts on the west and north side of Port Phillip Bay—Including the counties of Grant, Grantville, and Bourke, and the eastern parts of the counties of Hampden and Ripon.

I.1 South Central Districts east of Port Phillip Bay, &c.—Including the counties of Mornington and Evelyn.

K. Regions of Heaviest Rainfall—including all the mountainous Eastern Districts, and South Gippsland.

L. South-eastern Districts—Gippsland, and counties on the New South Wales Border.

M. Extreme East Coast.

CHEMICAL BRANCH.

RESULTS OF MANURE EXPERIMENTS, 1901–2.—NORTHERN AREAS.

By F. J. Howell, Ph.D.

I contributed to the *Journal* of February a description of the various field experiments carried out in different parts of the State by this branch. The results from a great number of the fields have already reached this office, and have been tabulated, criticised, and reported on to the Agricultural Societies concerned. The returns, to prove of immediate use to farmers, had to be prepared hurriedly, and placed in the hands of the country press for publication prior to the purchase of manures for the present season. The work has been heavy, and I have to thank Mr. Hatton, the head of the clerical staff, for the great assistance he has given me in the thousands of calculations required, as well as the preparation of the necessary tables. Tabulated returns and exhaustive reports have been sent out to 27 districts. These were all, with the exception of one, in the hands of the secretaries of the Agricultural Societies a little later than the middle of February. In addition to these tables and district reports there were sent to each individual farmer returns showing the results of the single experiment carried out on his farm, with the calculated profits from the increased yields produced by each manure used. The following tables show the form employed, and will give some idea of the information conveyed:—

Statement of the Results of the Experimental Manure Plots at the Farm of Mr. G. Telford, Mount Pleasant, Sown 25th May, 1901, on Sandy Loam. Harvested December, 1901.

No. of Plot.	Crop—Wheat (Ward's Prolific). Manure given per Acre.	Yield per Acre.	Gain Due to Manuring.
		Bushels.	Bushels.
1	11 lbs. concentrated superphosphate ...	20·33	4·33
2	No manure	16·00	
3	22 lbs. concentrated superphosphate ...	24·00	8·00
4	33 lbs. concentrated superphosphate ...	24·50	8·67
5	No manure	15·83	
6	51 lbs. ordinary superphosphate ...	23·66	7·83
7	54 lbs. Thomas' phosphate	21·50	6·17
8	No manure	15·33	
9	46 lbs. bone-dust	17·50	2·17
10	Same as plot 6, together with 48 lbs. sulphate of ammonia	21·83	6·83
11	No manure	15·00	
12	Same as plot 6, together with 87½ lbs. dried blood	23·50	8·50

The figures below show the profits on the manures used :—

—	Plot 1.		Plot 3.		Plot 4.		Plot 6.		Plot 7	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Value of increased yield, at 3s. 3d. per bushel	14	0¾	26	0	28	2	25	5¼	20	0½
Cost of manure per acre	1	4	2	8	4	0	2	2	2	2
Profit per acre, due to manuring ...	12	8¾	23	4	24	2	23	3¼	17	10½

It seemed to me that the district reports might prove of wider interest than the limits of the small area concerned, and that the collection and reproduction of all the reports that had left this office might furnish interesting reading for the whole of our farming community. The pages of our *Journal* give me the opportunity of carrying out the idea, and I shall collect and contribute, from month to month, the reports on some of the very interesting results which the farmers of Victoria have helped me to gather. There will be found in this year's tabulated returns of each district the average results also of the preceding year, which might serve for comparison with those of our last year's experiments. The manures used in both years differed very little. The slight variations in kind and quantity will be shown by a comparison of the figures below.

MANURES USED IN FIRST YEAR'S EXPERIMENTS.

Plot 1.	Plot 3	Plot 4.	Plot 6.	Plot 7.	Plot 9.	Plot 10.	Plot 12.
10 lbs. concentrated superphosphate.	20 lbs. concentrated superphosphate.	30 lbs. concentrated superphosphate.	50 lbs. ordinary superphosphate.	56 lbs. Thomas' phosphate.	50 lbs bone-dust.	Same as plot 1, with 36 lbs. sulphate of ammonia.	Same as plot 3, with 72 lbs. sulphate of ammonia.
LAST YEAR'S EXPERIMENT.							
11 lbs. concentrated superphosphate	22 lbs. concentrated superphosphate	33 lbs. concentrated superphosphate.	51 lbs. ordinary superphosphate.	54 lbs. Thomas' phosphate.	46 lbs. bone-dust.	Same as plot 6, with 48 lbs. sulphate of ammonia.	Same as plot 6, with 87½ lbs. dried blood.

An Examination of the Results.

THE TATURA EXPERIMENTS.—(See Table 1.)

The yields on the various plots are shown in the first line of figures, while those in the second line indicate the increase due to the use of manures. It is to be regretted that for the 1901 season there were experiments carried out on two fields only in this district compared with five in the preceding year. The results, however, for the last year are of a very gratifying nature, and conform more closely than they did last year with the increased yields obtained at that time in other

portions of the wheat-growing area of our State. As in the last year's experiments the soils of the district show themselves particularly responsive to phosphatic manures, the nitrogenous showing little or no effect generally. In the case of Mr. Manning, however, the sulphate of ammonia in conjunction with the superphosphate has shown some slight increase over the application of the superphosphate alone. This also appears to be the case in plot 12, where the nitrogen has been given in the form of dried blood. But the increase is not sufficiently great to make the application of these manures profitable. A noteworthy feature in this year's experiments is the much better results obtained where the ordinary superphosphate has been used (plot 6) than where an equivalent quantity of the concentrated has been applied (plot 3). The farmer will understand that 22 lbs. of concentrated superphosphate and 51 lbs. of ordinary superphosphate used in the experiment contain the same amount of phosphoric acid, and ought, theoretically, to give the same increase in yield. The better results obtained by the use of the ordinary superphosphate can, however, I think, perhaps be explained in the case of the Goulburn Valley soils by their poverty in lime. Chemical analysis has already revealed the fact that many of them are poor in lime. The ordinary superphosphate contains a quantity of lime in the form of sulphate of lime or gypsum, which is not the case in the concentrated; and it is possible that good results might follow the farmers adding still more to the ordinary superphosphate they use. Burnt lime could not of course be added to a superphosphate, but 50 lbs. of gypsum per acre added to the usual quantity of superphosphate used would cost very little, and basing my opinions upon the results of this year's experiments might, I think, result in a further increase in yields. The experiment is worth trying on a small scale, especially on the heavier clay soils of the district and the extended use of gypsum is not advised without preliminary experiment.

The splendid increases in yields following the use of, comparatively speaking, such small and inexpensive quantities of manures as were used in our experiments ought to prove highly pleasing to the Tatura farmers. That it should be possible to secure an increase of 7·09 bushels per acre with 51 lbs. of ordinary superphosphate, costing only 2s. 2d., seems something approaching the marvellous. The profits resulting from the use of the 51 lbs. of ordinary superphosphate on the two Tatura fields may be put down as follows:—

Cost of manure per acre	2s. 2d.
Value of 7·09 bushels of wheat, at 2s. 6d. per bushel ...	17s. 8½d.
Profit per acre due to manuring	15s. 6½d.

THE KYABRAM EXPERIMENT.—(See Table 1.)

The only experiment in the Kyabram district last year was carried out by Mr. Archibald, of the Tatura Agricultural Society. The results are in close agreement with those of the Tatura experiments. Attention might be also called in this case to the better results obtained from the ordinary superphosphate on plot 6 than the equivalent quantity of concentrated on plot 3, strengthening my assumption that the

presence of gypsum in the ordinary superphosphate might be responsible for this. I should advocate the farmers of this district also in either assisting this branch to make or making themselves a few small tests with a mixture of gypsum and superphosphate. That some of the soils in this district must be poor in lime is evident from the results obtained on the two fields of the preceding year. In that year not only the ordinary superphosphate, but Thomas' phosphate, also gave better results than the concentrated superphosphate on plot 3, all containing equal quantities of phosphoric acid. It is quite unusual on the soils of the greater part of our wheat-growing area for Thomas' phosphate to give results at all comparable with the superphosphates. In the case, however, of a soil very poor in lime this might happen. Thomas' phosphate contains large quantities of free lime.

THE SHEPPARTON DISTRICT.—(See Table 1.)

Special thanks are due to this district for the great interest shown, the large number of farmers who took the matter up, and the prompt manner in which all furnished returns. This is the first year that experiments have been conducted in this district, and in this case no comparison can be made with returns from a preceding year. The returns show the average of seven fields, and, while the increased yields do not reach those of the two districts just dealt with, they are of a most satisfactory nature. I would also direct attention in this case to a comparison of the results on plots 3 and 6. The ordinary superphosphate, as in the two preceding districts, has proved slightly more effective than the equivalent quantity of the concentrated form. It seems, then, reasonable to think that some of the Shepparton soils, like those of Tatura and Kyabram, but not apparently to the same extent, might be benefited by an addition of lime. This might be given in the form of gypsum, mixed either with the ordinary or concentrated superphosphate. The returns on plot 12, where dried blood has been used, seem to indicate that some of the soils experimented on might be a little poor in nitrogen. This is probably the case where a system of continuous cropping has been followed. Such soils would most probably recover by letting out for a year or two or by the growth where possible of some leguminous crop, such as lucerne, trefoil, peas, &c. In connexion with the possible exhaustion of our soils in nitrogen, it might be of interest to repeat here my remarks contained in the *Year-Book* of last year.

The Nitrogen Question.

"Here again we have one of the most interesting problems in the manure question, and one that can be only properly probed by continuous tests over a number of years on the same field as indicated above. Generally speaking, an addition of nitrogen to our crops results in a very small or no increase, and sometimes leads to a reduction in the yield. Such an experience is quite contrary to the European, as clearly brought out in the classical experiments of Lawes and Gilbert, and finds at least one explanation in the more active nitrification

of our soils, favoured by the difference in climatic conditions. It is a question, however, owing to the much larger crops we are at present able to secure by the application of a purely phosphatic manure whether the nitrifiable matter of our soils will be sufficient to provide the nitrogen necessary for these larger crops, over any lengthy period of time, or whether there will not be a gradual falling-off in yields owing to the exhaustion of this nitrogenous matter. Under our present system of taking a crop once in three years, and devoting the other two to grass and bare fallow, such a contingency is, I think, not probable. There is just the possibility, however, of farmers, owing to the increase obtained from the use of manures, giving up more largely the year of grass, or at least the bare fallow on which they formerly depended for this result, and adopting in places a system of continuous cropping. (The more extensive keeping of sheep will, of course, do away with this state of affairs.) There is no doubt that in years of a good rainfall crops are obtainable from the stubble with phosphatic manures for successive years, as good, or almost as good, as those from the fallow, but should such a system of continuous cropping ever find favour, it would most probably have as its sequence the exhaustion of the soil nitrogen and the gradual falling-off in effective power of our phosphatic manures. Under the three-year system of crops, grass, and fallow at present pretty general in our drier districts, such an exhaustion of nitrogen is, as I stated, a remote possibility. The average farmer is, perhaps, unaware that the trefoil, clovers, and other leguminous plants that find a place during the year of grass in the natural herbage of the portion of the farm he leaves out, perform a singular and valuable service for him by accumulating in a wonderful way large quantities of atmospheric nitrogen, and leaving them in the ground for the benefit of crops that follow. The bare fallow also exercises its good effects in the increase of the available nitrogen, and perhaps the absolute gain of the soil in this ingredient in other ways. An examination of such facts will show that a year's results from an experimental field cannot give us all the information we require in this direction. Experiments must continue on the same field with the same manures over a long series of years, under the conditions of continuous cropping, cropping with an alternative year of fallow and cropping, with the two intervening years of pasture and bare fallow. The effect of a leguminous crop to take the place of the year of grass should also be tested."

Remarks on the General Average of the Three Districts.

The average of the ten fields in the three districts is a striking confirmation, in most respects, of the general average of results obtained last year through the wheat-growing area of Victoria. The great soil deficiency stands out prominently as that of phosphoric acid, and the ready response of the soils where the manure containing this ingredient alone has been used, is in strong contrast to the slight increase produced, in most cases, by the further addition of either a nitrogenous or potash manure. In plot 10, where nitrogen has been given

in the form of sulphate of ammonia, there is practically no increase over plot 6 where phosphoric acid alone in the shape of a superphosphate has been applied; but in plot 12, where nitrogen has been given in the form of dried blood, there has apparently been a certain effect produced that demands consideration, but too small to warrant the cost incurred by such an application. Where soils through continuous cropping are beginning to show signs of exhaustion in nitrogen, the cheaper way for the farmer to meet this will be by occasional rotation with one of the leguminous crops referred to, or by the letting out occasionally to pasture. Attention might be again called in the general average of the ten fields to a comparison between plots 3 and 6. It seems, as already stated, a feature peculiar to the soils of the Goulburn Valley, that equivalent amounts of ordinary and concentrated superphosphate containing equal quantities of phosphoric acid produce such different effects. In the general average it will be seen that there is more than a bushel difference in favour of the ordinary. It is always unwise to draw conclusions from a limited number of experiments conducted for one year only, and before advising farmers I should like further experiments conducted in co-operation with this branch. But the indications are that the better results obtained from the use of the ordinary manure are due to the sulphate of lime contained in that manure, and that many of the Goulburn Valley soils may be considered such as would be benefited by an application of lime. If given with the superphosphate, gypsum would be the proper form. An amount that would probably be found sufficient would be about 50 lbs. to the acre mixed with from 50 to 75 lbs. of ordinary superphosphate. Where the equivalent quantity of concentrated superphosphate is used a larger amount of gypsum would be required. It is, of course, advisable that the farmer should first make tests on a small scale, as it is unknown whether the soils experimented on are representative of a large area. The negative results on plot 19, where lime has been used, might be taken as an indication that lime would produce no effect, but it will be seen that lime alone has been applied, and not the much more important requirement phosphoric acid as well. Lime alone under these conditions could be hardly expected to produce an effect. To sum up, then, the farmers of the three districts may be advised in full confidence to use as the most profitable and suitable manure a good ordinary superphosphate in quantities of from 50 to 75 lbs. to the acre, while the results of the experiments seem to indicate that an addition of 50 lbs. of gypsum to the superphosphate might still result in a further increase in yield on some of the soils. To determine this point, however, with certainty, I should like some of the farmers in each district to carry out experiments under my direction as before stated.

Criticism of the Cobram-Nathalia Results.—(See Table 2.)

The returns of these districts are not of such a nature as to create enthusiasm. As was the case last year, they will probably be the lowest of any portion of the State, but there is no reason that this should continue so, and my faith in the possibility of manures proving

just as effective in this part of Victoria as in other portions similarly situated remains unshaken. The names on this list are by no means all of those who co-operated with the Department last year in these districts. There are others who have already reported their attempts as failures. The names on this list are, with the exception of the six, those who have not yet reported on the outcome of the experiment, and they have been included in the hope that something might be still heard from them. Indifferent as the results are, the average of the five fields still shows a profit sufficiently large to justify the use of manures, as is evident in the following figures :—

—	Plot 3.	Plot 4.	Plot 6.
Value of increased yield at 2*s*. 6*d*. per bushel	4·1¾	6·6½	5·3
Cost of manure	2·8	4·0	2·2
Profit due to manuring ...	1·5¾d.	2·6½d.	3·1d.

If we take the returns of Mr. Williams only the results are of a very much more satisfactory nature :—

—	Plot 1.	Plot 3.	Plot 4.	Plot 6.
Value of increased yield at 2s. 6d. per bushel	4·9	8·8	9·2	9·4
Cost of manure	1·4	2·8	4·0	2·2
Profit due to manuring ...	3·5d.	6·0d.	5·2d.	7·2d.

An examination of the general results indicates that the soils of these districts show a great similarity in their wants to those of other portions of the Goulburn Valley. Nitrogen seems to produce no appreciable increase, and the ordinary superphosphate in the Nathalia group at any rate has shown itself more effective than the concentrated. The tests are not sufficiently numerous to warrant one speaking too definitely, but the results obtained so far indicate that phosphoric acid is the principal, perhaps the only, requirement, although it is desirable that tests in one or two other directions should be made, and I hope a few farmers will co-operate with the Department in carrying them out. Mr. Mortimer's results are naturally not included in the smaller fields, and will be dealt with among the larger fields at a later period.

Reason of the Small Yields.

On going carefully through the correspondence of the farmers bearing upon the indifferent results obtained, I was struck by the same reasons assigned by nearly all of them. Both in the experiments of the first and second year the nature of the weather prevailing did much to operate against our success. The first year continuous and heavy

rains, commencing just after our officer visited the district, delayed the putting in of the plots for several weeks after his arrival. The date of his visit was already too advanced to give any great guarantee of success, but this additional delay increased still further the probabilities of failure. In the last year's experiments the plots were got in very early on well-worked soil, but the exceptionally heavy rains almost immediately following, with three days of strong drying winds, appeared to have set the ground to such an extent that the greater portion of the seed never got through. That this was the cause of the light yields in most cases is evident from extracts taken from the letters of some of the farmers.

Mr. Kilpatrick writes :—"The cause of failure, in my opinion, was that after sowing there was a very heavy rain, and the ground, being prepared very fine, got caked. There was a very strong wind for about three days after the rain, which dried the surface up very quickly, and the young shoots never got through—the result being that only about a quarter of the grain grew. The crop alongside *I harrowed after the drying, with good results.*"

Mr. Harding states :—"After the plots were sown a heavy fall of rain took place, nearly 2 inches. On visiting plots nearly a month afterwards, I was surprised to find hardly any had come through, so that at harvest-time there was nothing to strip, which has disgusted me with drills."

Mr. Wm. H. Tyack writes :—"I think, sir, the reason of the failure is that a day or two after it was drilled in it came on to a lot of rain, about 2 inches. The water lodged in the drills. When the wheat didn't come up the grass and wild oats did."

Mr. Geo. Power states :—"It did not come up satisfactorily, like the crop adjoining, so I cut it for hay."

The returns of this hay crop, however, on the various plots, are, from the experimental point of view, of great interest, and I give them :—

—	Yields per acre.	Increase due to manures.	—	Yields per acre.	Increase due to manures.
Plot 1	·60 tons.	·20 tons	Plot 7	·78 tons	·08 tons
" 2	·40 "	—	" 8	·70 "	—
" 3	·59 "	·19 tons	" 9	·69 "	·03 loss
" 4	·72 "	·47 "	" 10	·93 "	·06 gain
" 5	·25 "	—	" 11	·87 "	—
" 6	·90 "	·65 tons	" 12	·93 "	·06

There have been substantial increases in plots 1, 3, 4, and 6, even in a crop that came up so thinly, sufficient to indicate that under more suitable conditions the soil is one that would respond freely to the action of manures. It would be very interesting if the farmers who had plots last year, and reported them as failures, would have the pegs replaced in their old positions, and note the differences in the crop of the following year. I have every reason to believe that

there will be very observable differences, for the manures are still in the ground. Mr. Corry's remarks on this point are worth giving. He writes referring to the ground used for experiments two years ago :— "I noticed that the crop on the land that had the plots the previous season was better headed, and carried a better grain." Had the weights been taken, there is every reason to believe that differences just as marked would have come out here as well.

Criticism of Results—Birchip, Donald, and St. Arnaud.—(See Table 3.)

The St. Arnaud Group.

The St. Arnaud, like the Jeparit district, can lay claim to having co-operated with the Chemical Branch in field experimenting for a period of three years. The results obtained have not only been of value to the district, but have had their influence on the agriculture of one-half of Victoria, and personally I felt the value of the facts they enabled me to lay before the many gatherings of farmers I have had the pleasure of addressing for the last two years. The Agricultural Department is specially indebted to the assistance and co-operation principally of two gentlemen in the district—the president of the society, Mr. George Telford, and one of its most active members, Mr. Mackay—while the services of the late Mr. Scott were held in memory by my late chief, and are not forgotten by me.

The First Attempts at St. Arnaud.

The first attempt at experiments in manuring by Messrs. Telford and Mackay were made in the year 1898, when the following plots were put down, giving the results below :—

Plot.	—	Yields per acre. Mr. Telford.	Yields per acre. Mr. Mackay.
1	10 lbs. concentrated superphosphate ...	16·46 bushels	7·42 bushels
2	No manure	12·51 ,,	6·08 ,,
3	20 lbs. concentrated superphosphate ...	18·22 ,,	9·43 ,,
4	30 lbs. concentrated superphosphate ...	18·22 ,,	11·35 ,,
5	No manure	11·63 ,,	6·95 ,,
6	26 lbs. ordinary superphosphate ...	15·58 ,,	8·34 ,,
7	26 lbs. Thomas' phosphate	13·84 ,,	6·18 ,,
8	No manure	12·73 ,,	3·36 ,,
9	10 lbs. concentrated superphosphate 20 lbs. nitrate of soda	13·84 ,,	3·48 ,,
10	10 lbs. concentrated superphosphate 40 lbs. nitrate of soda	13·39 ,,	4·64 ,,
11	No manure	12·08 ,,	4·75 ,,
12	15 lbs. concentrated superphosphate 60 lbs. nitrate of soda	14·27 ,,	7·65 ,,
13	15 lbs. concentrated superphosphate 46 lbs. sulphate of ammonia ...	13·84 ,,	8·23 ,,
14	No manure	11·19 ,,	7·07 ,,
15	39 lbs. Thomas' phosphate ... 60 lbs. nitrate of soda	14·27 ,,	6·95 ,,

I received my appointment in August of the year of the experiments. In December these results were in my hands, together with those from Jeparit, and from that time on I faced the farmers of our drier areas with a confidence supported by facts which I knew had solid foundations.

The St. Arnaud Experiments of the Following Year.

The results of the fields of the following years are given in the preceding tables, and will be compared in due time with the returns of last year, but in the second year of the experiments there were results apart from direct increases due to the different manures obtained by Mr. Telford, which again gave room for thought and may yet have their influence. The manure tests of both 1900 and 1901, the latter of which are at present receiving attention, show clearly that the superphosphate is a far more effective form of a phosphatic manure than Thomas' phosphate, the difference being due to the greater solubility of the phosphoric acid in the first than in the second, this difference enabling the plant to appropriate a greater quantity of the one for its requirements than the other, a greater portion of the less soluble form remaining in the ground. It was interesting, then, to see to what extent this unexhausted residue of Thomas' phosphate might be operative on the crop of the following year, and the plots of 1899 were again sown with the same manures for a second time. The results obtained by Mr. Telford were interesting, and showed plainly, as might have been expected, that the residual manure from the first year in the Thomas' phosphate plot gave strong evidence of its presence in the second year. The returns were as follow, as taken from Mr. Pearson's calculations :—

—	Yields per acre.		Net gain due to manuring two years.
	1899.	1900.	
26 lbs. ordinary superphosphate ...	15·58 bushels	166·7 bushels	6·64 bushels
26 lbs. Thomas' phosphate	13·84 ,,	19·17 ,,	6·15 ,,

Whether such results would be obtained generally could only be answered by a number of tests, and too much reliance must not, of course, be placed on a single experiment.

The Results of Last Year's Experiments in the St. Arnaud District.

After the short retrospect of the results obtained in the St. Arnaud district for the two preceding years, our attention can now be devoted to the returns of last year, comparing them with those of the periods

already dealt with. It will be satisfactory to the farmers of the district to learn that, not only have the results of former years been confirmed, but that the present year's returns, as far as the increase due to manures is concerned, are better in some cases than they ever were before, and this in a season recognised everywhere as a most unfavorable one. The average of the five fields is a splendid one. The returns from each plot are slightly below the returns of the preceding year, but when the increased yields due to manures are considered, there is little difference, plots 3, 4, 10, and 12 showing even higher figures than in the returns of the year before. The average of the unmanured plots of the experiments under review is 11·22 bushels per acre. In the year preceding the average worked out at 12·55 bushels, a bushel and a third difference. Taking, however, the average of the five plots treated with phosphatic manures, the only ones perhaps requiring serious consideration, we find that last year's returns give an average of 17·26 bushels compared with 18·21 bushels of the preceding year, a difference of less than a bushel, while as regards the increase due to manures the returns of the two years are practically identical, being 5·96 bushels in the earlier experiments, and 5·81 bushels in the latter. On plots 3 and 4 there is a decided advantage in the increases of the last year.

A comparison of plots 10 and 12 with plot 6 or plot 3 in the general average reveals a slight difference in favour of nitrogen manuring in the last year's tests. The difference, however, is not sufficiently marked to alter the opinion formed from the experiments of preceding years that the soils of the district are not in any immediate need of nitrogen manuring. The individual returns of Mr. Brain on the two plots specified have influenced the general average. There may be reasons unknown to me that have caused the soil to run down in nitrogen on this farm. As indicated on plots 19 and 20, an application of lime and potash seems to have been without effect, and it is most probable that all the soils of the district are sufficiently well provided with these two ingredients. On plots 28 and 30 it was intended to test the ploughing in of a manure at a depth before sowing against drilling in with the seed. The arrangements and assistance were, however, not to hand for carrying this out, and the officer was compelled to make the application in both cases with the drill. The importance of a test of this sort might not strike the farmer, and yet in our dry districts the application of the manure we give at a depth from the surface might have very important bearings on the after-success of the crop. It appears feasible that encouragement for root development at a depth in the soil should favour a crop's drought-resistant powers far more than a procedure calculated to act in an opposite direction. Although the plots failed in the direction intended, they, however, have perhaps proved of value in another way, for they show that on this farm at any rate the maximum profitable dressing is by no means within the limits of plot 4, but that instead of 76 lbs. of an ordinary superphosphate, 112 lbs. of the same manure may be used with the greatest advantage, showing a profit of £1 per acre. The results warrant farmers making small tests with the larger application.

AN EXPERIMENT IN TILLAGE.

In a lecture I delivered on Tillage in many parts of Victoria I used the following language:—"Have we by a properly-conducted system of bare fallowing reached the limits of our means of retaining the moisture in our soils? Is there not a loss during the growth of the crops that might also be very largely decreased? There is, and the prevention of this loss lies in the application of the same treatment to the growing crop as we gave to the bare fallow. Stirring the bare soil without a crop resulted in the saving of moisture. Stirring a soil under crop will produce the same effect. We laughed at first at the idea of drilling a crop. We laugh now at the mention of its cultivation. But the drill has come to stay, and the horse hoe must follow as its necessary complement, and the effect of its use in the retention of moisture will be just as pronounced in the growing crop as that of the cultivation on the fallows.

"I am sure some of you have grown a few rows of peas or some other garden crop at one time in your lives, and in the spring, when the ground looked hard and baked, you have taken your hoe or pronged fork and loosened the soil between the rows. The effect a week after has, I know, struck you as magical. The reasons of that effect you must, from all I have told you, have already guessed. The loose surface on top has acted like a mulch, and prevented the moisture that commences to rise from below to the surface when the warm weather sets in from evaporating into the atmosphere. Treat your wheat or barley or oats in a similar manner, and you will find the same ready and grateful response."

It is a great pleasure to find the truth of such preaching confirmed by the actual test in the field, and I can congratulate the St. Arnaud district for having broken ground in another direction. The horse-hoeing test was carried out by Mr. Mackay, and, as will be seen on plots 31 and 33, with good results.

Plot 33, without manure, shows an increase of 2·83 bushels per acre due to the operation alone, while a comparison of the increase on plot 31 (manured) with plot 6 indicates much the same effect in this case also. Mr. Mackay is the only farmer who has reported carrying out the operation, and he writes:—"The plots were hoed twice, 16th September and 4th October. With regard to the hoeing I am confident it was done much too late. I am confident that if it had been done earlier the results would have been much better. However, it is a lesson on the advantage of tillage for which I am very thankful."

THE DONALD EXPERIMENTS.

In 1900 there was available from this district an average of three fields to draw conclusions from. Last year we secured returns from four. In the first year's experiments the actual yields of the various plots right through were higher than those of the second, but in the second year's returns it will be seen from the tables that the increases due to manures were considerably larger than in the preceding season. The manures, however, used in some of the plots were a little

higher than formerly. Taking the average of the unmanured plots in the first year's experiments, the figures work out at 13·91 bushels, while the corresponding plots for the second year give 10·34 bushels only, a difference of more than 3½ bushels. On the five plots treated with phosphatic manure, there is an average yield of 17·25 bushels in the first year, compared with 14·21 bushels in the second, a difference of three bushels only; while the average increase due to manure on these plots is 3·95 bushels in the last year's experiments, compared with 3·37 bushels in the preceding year. The superphosphates in both years have given appreciably better returns than Thomas' phosphate. On the plots where nitrogen has been used the increased returns in the latter experiments are better than those of the former years, a fact which also came out in the St. Arnaud fields. Taking the average of the two nitrogen plots in the season of 1901, we obtain 3·78 bushels, compared with 2·40 only in the season before. The results then of the present year confirm in all the main essentials the lessons of the preceding one. The soils of the district respond to phosphatic manures, and are sufficiently well provided for the present with nitrogen. Among the phosphatic manures, superphosphate has shown a marked superiority over Thomas' phosphate, and a much more pronounced one over bone-dust. The tests on plots 28 to 33 were not carried out as intended, and can be neglected.

AN ADDITIONAL TEST.

In addition to the four fields just dealt with, a test similar to the one carried out by Mr. Telford, of St. Arnaud, was undertaken by Mr. Moore last year. That is, the manures were repeated a second time on the same plots. The yields for both years have been very fine, but the increases due to manures have not been so marked, although in the lighter applications the effect produced is by no means inconsiderable. The yields for the two years, with increases, are given below:—

YIELD 1900.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
10 lbs. Concentrated Superphosphate.—1s. 1½d.	—	20 lbs. Concentrated Superphosphate.—2s. 3d.	30 lbs. Concentrated Superphosphate.—3s. 4½d.	—	50 lbs. good ordinary Superphosphate.—2s. 3d.	56 lbs. Thomas' Phosphate.—2s. 3d.	—	50 lbs. Bonedust.—2s. 3d.	10 lbs. Concentrated Superphosphate and 36 lbs. Sulphate of Ammonia.	—	20 lbs. Concentrated Superphosphate and 72 lbs. Sulphate of Ammonia.
24·75	21·67	27·00	23·17	23·01	25·33	25·17	21·92	21·33	21·58	21·17	28·67
2·08	...	4·89	·62	...	2·68	2·88	...	(·34 Loss)	0·16	...	7·50
YIELD 1901.											
19·58	17·33	18·50	18·66	17·83	20·16	20·00	17·08	18·50	19·66	18·08	21·75
2·25	...	1·17	·83	...	2·33	2·92	...	1·42	1·58	...	3·67

It would appear from the returns of both years that the soil of this farm is a good one, showing no very active response to the application of manures. The heavy application on plot 3 seems in both years to have resulted in a decrease in yield compared with the lighter applications. Thomas' phosphate in both years has given better results than the ordinary superphosphate. The profits of the manures used on plots 1, 6, and 7 in 1901 are sufficiently high to justify light applications:—

—	Plot 1.	Plot 6.	Plot 7.
Value of increased yield due to manure at 2s. 6d. per bushel	5·7	5·9¾	7·3½
Cost of manure	1·4	2·2	2·2
Profit per acre ...	4·3	3·7¾	5·1½

The Birchip Field.

There are only returns from one field at Birchip, against four for the preceding year. The increases, however, on Mr. Beckham's field are very satisfactory. The returns give evidence of the experiment having been carried out with care; the results on plot 6 are, comparing them with plot 3, a little difficult of explanation. I think with the facts before me I am justified in saying that the only deficiency requiring attention in this soil is phosphoric acid. The farmers of the district can be advised in all confidence to apply superphosphate to every cereal crop they grow.

EXPERIMENTS IN BEET-GROWING IN GIPPSLAND.

By F. J. Howell, Ph.D.

In addition to the experimental beet plots that were established in the country immediately surrounding Maffra, there were put down some 30 fields in a few other districts of the State, some of the returns from which are now available. The following is a report furnished by me in March to the Secretary of the Traralgon Agricultural Society. It would have been more to my liking to have included it as part of a complete article on the whole of the beet experiments in the country, but the desire for early information on the results in different parts of Gippsland and the Western District make it perhaps advisable to give the returns earlier publicity. The following figures are of great interest :—

RESULTS OF ANALYSIS OF SUGAR BEETS FROM EXPERIMENTAL PLOTS AT TRARALGON, GLENGARRY, COWWARR, AND FLYNN'S CREEK.

District.	Average Weight per Root in Grammes.	Number of Roots per Chain.	Weight of Roots per Acre.	Sugar in Juice.	Sugar in Root.	Purity.	Tons of Sugar per Acre.	Value of Crop at Factory Prices.		
			Tons.					£	s.	d.
Bradens, Traralgon ...	793·79	78	30·164	15·2	14·1	80	4·253	22	12	5
Widdis, C., Traralgon ...	291·03	77	10·917	20·85	18·93	92	2·066	12	5	7
Walker, A., Traralgon...	700·51	68	23·207	17·9	16·2	88	3·759	20	17	8
Widdis, C., Traralgon ...	505·09	77	18·947	15·875	14·2	85	2·147	14	4	2
King, J., Glengarry ...	419·57	70	14·309	15·55	13·6	79	1·946	10	3	10
King, W., Glengarry ...	199·92	74	7·207	18·45	16·95	91	1·221	7	0	6
Birmingham, Glengarry	432·78	140	29·586	18·0	16·75	92	4·955	27	14	9
Beard, Cowwarr ...	335·45	80	13·07	20·3	17·8	91	2·327	13	4	8
Thomson, W., Cowwarr	423·35	80	16·50	20·05	18·0	95	2·97	17	6	6
Neilson, Cowwarr ...	258·49	83	10·45	20·625	18·8	89	1·965	11	7	3
Kitto, Cowwarr ...	685·73	86	28·73	17·35	16·4	90	4·712	25	17	1
Bell, W., Flynn's Creek	249·76	78	9·49	19·5	17·75	79	1·680	9	12	2
Onley, A. J., Flynn's Creek	210·35	120	12·29	20·975	19·85	87	2·441	14	5	8
Average of 13 fields	...	...	17·29	...	16·87	87	2·80	15	17	8

The very fine returns from the experimental plots in the Traralgon, Glengarry, Cowwarr, and Flynn's Creek districts come at an appropriate time, and may possibly have some influence in deciding the future of the industry at Maffra. Such returns ought at least to prevent any precipitate agreement to proposals for immediately dismantling the factory, and indicate the possibility under a system of cheap railway freights of supplying the factory in part from districts not yet considered as sources of supply. No chemist could contemplate such figures without some thrill of pride and enthusiasm—for they reveal, as returns from the Western District and other parts of Victoria already have done, how eminently suited the soils and climate of a great portion of our State are for the growth of the beet, and the building up of a great industry. I have exercised every precaution to secure accuracy in the

returns. The analyses were carried out in the laboratory in Melbourne. The work was placed in the hands of my very reliable assistant, Mr. Scott, who supervised the work in all stages, and made the sugar estimations himself in duplicate. It was my original intention to allow the farmers to send samples themselves, but to insure greater accuracy in this respect, I intrusted the work to one of my most careful field officers, Mr. Simpson Hill. From Mr. Hill's reports I have no doubt that thoroughly representative samples of roots were obtained. Instructions were given to the field officer to report on the appearance of the crop, the treatment it had received, as also generally on the soils of each district, and the area that might be considered adapted to the growth of the beet. The following tables refer to the first investigations :—

—	Mr. Braden.	Mr. C. Widdis. No. 1.	Mr. C. Widdis. No. 2.	Mr. A. Walker.
Nature of soil	Dark loam, river flats	Dark loam, river flats	Dark loam, hill-side	Dark loam, river flats
Depth of ploughing ..	10 inches ..	10 inches ..	12 inches ..	9 inches
When ploughed	Winter and spring	Winter and spring	Ploughed three times	Spring
Number of times cultivated	Three times ..	Twice ..	Twice ..	Three times
When thinned	Fourth leaf ..	Fifth leaf ..	Fifth leaf ..	Three times
How thinned	Very regular ..	Fairly regular ..	Fairly regular ..	Regular
General appearance of crop	Very clean ..	Fairly clean ..	Clean ..	Clean
Distance between rows ..	16 inches ..	16 inches ..	20 inches ..	16 inches

—	Mr. J. King.	Mr. W. King.	Mr. Birmingham.	Mr. Beard.
Nature of soil	Dark loam ..	Dark loam ..	Dark loam	Dark loam, river flats
Depth of ploughing ..	10 inches ..	8 inches	7 inches	9 inches subsoiled
When ploughed	Spring ..	Spring ..	Spring	Spring
Number of times cultivated	Several ..	Twice ..	Once	Twice
When thinned	.. .. ..	Fourth leaf ..	Not thinned	Fourth to sixth leaf
How thinned	.. .. ..	Fairly regular ..	Irregular	Regular
General appearance of crop	Very clean ..	Fairly clean ..	Dirty	Clean
Distance between rows ..	16 inches ..	16 inches ..	16 inches	16 inches

—	Mr. W. Thomson.	Mr. Neilson.	Mr. Kitto.	Mr. W. Bell.	Mr. A. J. Onley.
Nature of soil	Dark loam, river flats	Loam, hillside	Dark, loam, river flats	Dark loam ..	Loam
Depth of ploughing.. ..	12 inches subsoiled	10 inches subsoiled	8 inches ..	7 inches ..	7 inches
When ploughed	Spring ..	Spring ..	Spring ..	Spring ..	Spring
Number of times cultivated	Twice ..	Twice ..	Four times	Once ..	Once
When thinned	Fourth to sixth leaf	Fourth leaf	Fourth leaf	Fifth leaf ..	Fifth leaf
How thinned	Regular ..	Fairly regular	Regular ..	Fairly regular	Too thick
General appearance of crop	Clean ..	Clean ..	Very clean, well kept	Clean ..	Fairly clean
Distance between rows ..	16 inches ..	16 inches ..	16 inches ..	16 inches ..	16 inches

It will be seen that in three cases only did the ground receive more than one ploughing, while in no case did an autumn preparation of the soil take place. The depth of cultivation was in most instances below

that considered essential for the success of the beet, while the after cultivation of the crop received in a few cases only anything approaching the attention which lies at the basis of successful beet culture. Thinning, the most important perhaps of all operations, in the growth of the crop appears in many cases to have been delayed till too late a stage in the life of the plant. And yet with this minimum of labour and attention we find crops of a weight and sugar percentage equal perhaps to anything in the world. It is gratifying to find that, generally speaking, it is the better prepared ground and well cultivated crop that show the heaviest yields. The field officer, prior to the analytical results being known, described Mr. Braden's as a particularly well-kept crop. The yield of this crop, as the figures show, exceeded 30 tons of roots, of a value calculated on the factory prices that were given to me of £22 12s. 5d. per acre. The crops of Messrs. Widdis, Walker, Kitto, King, and others appeared to have received good attention. Against this argument for careful cultivation must be placed, however, the remarkable yield on Mr. Birmingham's farm. This crop was described as the most neglected and dirty in the district. The ground had only been ploughed to a depth of seven inches, received one cultivation, had not been, rightly speaking, thinned, carried 140 roots to the chain, and was dirty. The sugar percentage, however, was very high, and of a splendid purity, the value of the crop reaching £27 14s. 9d. per acre. In face of the neglect of the crop the figures appeared so startling that I felt disposed to think that some error might have been made in the bagging of the roots. Inquiry seems to indicate this was not so. The results, however, will be checked by a later analysis from a sample taken, if possible, by myself.

Taking the average of the thirteen fields it will be seen that the yield of roots per acre figure out at 17·29 tons; of a sugar percentage of 16·87, a purity of 87·0, and a money value of £15 17s. 6d. The highly profitable nature of the growth of the crop where such yields under such indifferent systems of cultivation can be relied upon, must, I think, be evident to all, without any comment from me. There is no wish on my part to unduly exaggerate the importance of such returns—there can be no object on the part of any officer of this Department to wilfully mislead farmers—but any officer assigned the duties of an agricultural chemist would fail in such duties did he not give full prominence to the meaning of facts such as those I have now the honour of bringing under your consideration. There is not the slightest doubt in my mind from the records of this office, and the results obtained by myself, that we have in Victoria large areas of country as well adapted, perhaps better so, for the profitable growth of the sugar beet as in any part of the world—and I offer it as a matter deserving attention by the Hon. the Minister, that one such area as shown by the present returns, is no very great distance from a well-equipped factory, for the dismantling of which suggestions have been recently made. That farmers would immediately undertake the growth of beet in this area in any considerable quantity, I have no knowledge and no guarantee—this would probably be a matter of education, and a question of time, but I would urge persistent efforts, through lecture and

experiment, to encourage the farmer generally, in suitable districts, to direct some attention to the crop—and the great possibilities of the industry.

The great obstacle put forward to the production of the beet crop is the labour difficulty. Conducted on proper lines there is no labour question. *For the profitable and successful growth of the beet we* must look, not to large areas, necessitating the employment of outside labour, but to small holdings worked by families. We must make the crop not a secondary matter, neglected at critical periods—and securing the attention of off moments only—but a primary consideration—with the other operations of the farm arranged as subsidiary to it. With a money return of £15 17s. 6d. per acre, an area workable by an average family would result in a yearly income, obtainable as a regular thing, *from no other crop that I know.* With probably 75 per cent. of the expenses of growing and harvesting the crop debited as wages for the labour of the farmer himself and family, the industry, it seems to me, offers one of the finest inducements for close settlement, and intense cultivation, of any that might be brought forward. It will be thought, perhaps, that the results of small experimental fields are no gauge of yields that would be obtained over large areas. There is no contention that they furnish anything more than approximations, but my experience is that, *on uniform soils, such as those experimented on in this* area, they provide very close approximations. The value of comparatively speaking small field tests, as indications of what might be expected over larger areas, found confirmation in our manure plots that were put down in all the northern parts of the State. The increased yields obtained by the Department were in many cases to my knowledge almost identical with those obtained on the same farm by farmers afterwards manuring large areas.

Area of Land suitable for Beet-growing.

According to instructions from me, inquiries were made as to the quantity of land in the districts named, which might be regarded as suitable for the growth of the beet. In the Traralgon district especially, there seems to be a very large area, the rich flats of the Traralgon Creek and Latrobe River forming from the point of view of adaptability of soil, ideal grounds apparently for the production of the crop. The rainfall is more regular, and better assured than in Maffra, and it says much, that in a season characterized, it is reported by residents of 35 years standing, as the driest for 30 years, that the beet crops have given the wonderful returns they have—maize in most places proving a failure. At Maffra, not many miles removed, but with a lighter rainfall, the dry season has undoubtedly seriously affected some of the crops, and the average yield of the plots will, I fear, be *disappointing, compared with those of former years.* It is an unfortunate circumstance that the industry should have had, for its infancy, the long, dry period that has been general for the last seven years throughout Australia. Crops that are recognised as suitable, and have been grown regularly in the district, have felt more than the beet the

effect of the abnormally dry seasons we have passed through, and this point, I would respectively ask, deserves consideration, if we are going to express opinions as to the suitability or otherwise of the climate of Maffra for the successful growth of the beet. Looking at the maize and potato crops of the year in the district, one would feel equally justified in pronouncing the climate totally unfitted for such crops. In seasons of a normal rainfall there is distinct evidence in the returns of crops grown during those periods that climatic conditions are suitable, and it would be unjust to take as the only test of suitability the returns of periods which, if meteorological records are to be regarded as reliable, must be recognised as abnormal. A comparison of the yearly rainfall for the last seven years, with the average for sixteen years previous, is of interest.

Rainfall Records in the Township of Maffra.

Month.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
January	0·74	0·98	3·27	0·22	3·67	1·12	2·54	2·61
February	0·75	2·65	7·50	3·13	0·16	0·24	0·32	0·58
March	1·77	1·27	0·77	0·80	1·13	3·70	1·59	...
April	1·25	1·22	1·13	0·27	6·71	4·49	2·55	...
May	0·65	0·89	4·04	5·16	2·19	4·88	0·64	...
June	1·70	5·03	0·52	0·84	2·54	2·04	1·34	...
July	0·53	0·62	1·33	0·56	1·13	1·39	2·02	...
August	3·88	2·86	3·97	1·67	3·10	1·12	2·98	...
September	2·03	3·86	1·16	2·26	0·52	2·67	1·25	...
October	0·37	1·02	1·56	1·81	2·38	0·33	1·65	...
November	0·12	1·66	0·63	1·54	1·17	1·59	1·06	...
December	2·71	0·81	0·43	0·06	1·48	0·74	0·46	...
	16·50	22·87	26·31	11·32	27·18	24·31	18·40	...

The district average rainfall for sixteen years previous to 1894 was, Mr. Lee informs me, 26·26 inches.

The crops planted in 1899 and 1900, years of a normal rainfall, were, according to returns published by Messrs. Van de Velde and Pearson, of a highly satisfactory nature—not nearly so good, it will be admitted, as they might have been under less crude and careless methods of cultivation. The analytical work in connexion with the beet plots at Maffra is this year very heavy, owing to the elaborate manure tests on each field. These experiments will, if the same numb r of tests are made through the autumn and winter as last year, necessitate 56 sugar analyses on each field, where fourteen only were carried out in the preceding season. So far analysis reveals a very high sugar percentage with yields lighter than in the preceding year. I hope to be able to furnish a statement of results some time during April.

THE TREATMENT OF THE COW.—HOW TO MILK, AND DAIRY MANAGEMENT.

A Lecture given to State School Teachers attending the Summer School, Training College, Melbourne, January, 1902.

By H. W. Potts.

In dealing with the daily routine of practical life on a dairy farm, the first and most urgent consideration is the health of the herd.

A Healthy Herd Indispensable.

Any cow exhibiting symptoms of disease or ailment should be promptly isolated, and any outbreak of disease must be reported to the local health authorities. Care should be exercised in excluding the milk either going to the creamery, factory, or in any other form passing into human consumption from such animals. The same precaution applies to cows giving blue, bloody, yellow, red, slimy, ropy, or other abnormal form of milk.

It is equally important that the milker should be free from any contagious, skin, or febrile disease.

Kindly Treatment means Higher Returns.

The teacher will do well to devote some time to impress his pupils with the knowledge that a cow is sensitive and easily disturbed, and that the milking habit and its development largely depends on the animal being treated in a rational manner. This may be illustrated by describing the action of the salivary glands in the mouth of a child when secreting spittle, saliva, or the fluid of the mouth, and how *the volume of saliva and the activity of its production is influenced* by pleasurable sensations, such as the odour of savoury food or ripe fruit when the child is cold and hungry. It may be pointed out how this flow of saliva is checked by the sensations of pain, excitement, fear, or anger. The salivary glands cease to elaborate and furnish the saliva. The mouth becomes dry and parched, and a desire to drink water or other fluids follows. In like manner the cow's udder is supplied by a vast number of glands, the functions of which include that of drawing milk from the circulation. They are stimulated by the maternal instinct, and this is encouraged and increased by a studious regard for the natural feelings of the animal. The character *of the milk is to some extent determined by the treatment accorded* the cow, not so much in quantity as in quality. The butter-fat contents, on which the commercial value of the milk depends, is lessened in response to harsh treatment or other adverse conditions, such as leaving the animals exposed to sudden changes, to low temperature, fast driving, the use of the stock whip or yelping dog, changing

the milker or time of milking, in fact any noise or treatment likely to create uneasiness, grief, pain, excitement, fear, apprehension, or anger. A similar reaction takes place in the function of elaborating milk in the udder as has been described in the secretion of saliva in the mouth.

This is more especially noted in well-bred cows, or deep, rich milkers.

It leads one to the common-sense conclusion that cows should be treated in a kindly, gentle, and sympathetic manner to secure the highest returns. In this lies the chief reason for employing girls or women to milk. Practice long ago demonstrated the fact that they secure a better yield from cows than men or boys. The patient, gentle disposition of the woman or girl is doubtless the factor in this case, and the conclusions naturally advanced are that a milker should be sympathetic, quiet and easy in disposition, clean in person, and of regular habits.

The Milking-shed.

The milking-shed should be lime-washed, exposed to sunlight, well floored and drained, and after milking all manure and filth should be brushed together and removed by a wheelbarrow to a depôt or manure pit at least two chains from the milking-shed or dairy.

Milking.

After bailing-up, the lower part of the cow's body should be cleansed with a dandy brush, the udder and teats washed, and all wiped with a damp cloth or towel. Fasten the cow's tail. The milker should wear clean overalls, have clean hands, and clean, well-pared finger nails. The prevailing system of wet milking should be abandoned in favour of dry milking. Dipping the fingers repeatedly into the milk to moisten the cow's teats is a filthy habit, and inoculates the milk with putrefactive organisms. These propagate, and ultimately are reponsible for objectionable flavours in the butter and cheese. Too much stress cannot be laid on the necessity for milking with a dry clean hand and teat.

The first few streams from each teat should be milked into a separate billy or can, to be scalded and sent to the pigs. This portion of the milk, as a rule, contains a large number of hostile bacteria.

When the cow is taken in hand she should be milked rapidly and firmly without interruption. The quicker the milking the richer the milk. The first portion milked is remarkably weak in butter-fat, but as the process continues it becomes richer, and the las. portion, known as the "strippings," is found to contain a high percentage of fat, occasionally up to 10% or 12%, and evidences the necessity for "stripping" thoroughly. Moreover, complete stripping encourages the milking habit; on the contrary, weak or ineffective stripping not only is a distinct loss in butter-fat, but tends to lessen or weaken the milk flow, and gradually spoils a good cow.

This is one of the reasons, very properly advanced, why young children should not be allowed to milk, owing to their physical incapacity to "strip" right out.

All objectionable noise or commotion about a milking-shed should be suppressed. Girl milkers in such countries as Denmark are encouraged to sing to their cows, and adopt other means of promoting contentment, ease, and pleasure.

Treatment of the Milk.

Every precaution should be adopted to exclude flies and insects from the milk bucket. When filled, the sooner it is removed from the ill odour of the cow-shed the better.

Despite all the care adopted in milking a number of bacteria or microbes have fallen into the milk, and in the warm fluid, surrounded with the most favorable class of nourishment for their growth, the organisms increase rapidly, and to prevent the subsequent changes evidenced in sourness, &c., it is essential to check their propagation by cooling in a pure, odourless, dust-free atmosphere to the closest approximation to 50° F. *It has been previously explained that at* this temperature most of the lactic acid or souring organisms cease to multiply.

The milk should be passed through a wire strainer, covered with a double fold of clean butter-cloth, and then passed over a Lawrence cooler. This appliance possesses the dual advantages of cooling and aerating at the same time. By the former a check is placed on the propagating and vital action of the bacteria, and by the latter the animal odour of the milk is dispersed.

(To be continued.)

ON DEHORNING GRADE DAIRY HERDS AND CATTLE FOR FATTENING.

By David Wilson.

There is a growing feeling among the raisers of fat cattle, especially where they have to truck their stock a considerable distance to market, that it would be of advantage to dehorn the animals intended for fattening, and, though I do not think any one would advocate the dehorning of pure-bred or stud cattle, the horn being one of the features of their breeding, the necessity and advantage to be derived from dehorning grade cattle must be apparent to any one attending the Flemington yards. Cattle often reach the fat pens cruelly horned by their vicious mates, their bodies are bruised, and must very often be unfit for shop purposes, and in consequence their value is depreciated. If the cattle were dehorned when stores, they would become more docile, they would suffer little inconvenience while in the railway trucks and fat pens, and their carcasses would eventually reach the abattoirs in good condition, and with more certain profit to every one concerned.

The advantages of dehorning also distinctly applies to the dairy herds; many a good cow is ruined by being horned in the udder, and a few vicious cows will often keep the herd, when yarded, in a nervous state, resulting in loss of milk and butter fat, besides being a constant anxiety to their owners.

A good example of the results of dehorning dairy cows can be seen on the estate of Mr. W. T. Manifold, of Purrumbeet. He has dehorned the bulk of his grade dairy herds. The method adopted was to dehorn all the cows in one dairy herd during the day. The result was they suffered little inconvenience with dehorning, there was a slight reduction in the milk return for about two milkings, the cows have become more docile when in the yards and at the watering troughs. They feed better together when given hay or other fodder in the paddocks; and the danger from injury through rushing each other has been reduced to a minimum.

The best place to dehorn grown cattle is in an ordinary crush, with gate on one side and bail in the front end of the crush. The two front posts in the end of the crush must be squared on the front or outside face, and the tongues of the bail be placed flush with the squared faces of main posts. A stout post with fork must be sunk in the ground close in front of the bail, so that the fork will be 2 feet above ground. A strong pole or lever is then attached to the squared face of one of the front posts of the crush, and when the cow is bailed up bring the lever down just behind the horns and force the animal's head into the fork beneath, where it can be held firmly for the few seconds that is required for using the dehorning machine. When the horns are removed, dress the hair round the butts with a mixture of Stockholm tar and kerosene, or tar and boiled linseed oil, equal parts; open the side gate of the crush and let the animal go.

The best and easiest way to have a hornless herd is to dehorn the calves—the age to operate on calves is when a month old or under—before the horny growth has burst through the skin. Procure some dehorning powder, a veterinary mixture of caustic potash and lime is the best; a bottle of powder costing two shillings and sixpence will with care dehorn 150 calves or over. Put a little of the powder into a spoon or tin, and by adding a few drops of water mix into a stiff paste; it is then fit for immediate use.

Lay the calf on its side and have it held firmly, remove the skin or top of the budding horns with a sharp knife, and apply the paste with a smooth flat stick, rub evenly till the parts turn brown or sear and the bleeding stops.

One application is all that is necessary, and the animal will have the appearance of a natural poley, and suffer very little with the operation.

LUCERNE IN GIPPSLAND.

By R. T. Archer.

During my recent visit to the Bairnsdale district, I was agreeably surprised and pleased to see on Mr. David Hill's Lindenow estate 100 acres of lucerne. Three years ago 6 lbs. of seed per acre were sown in drills 6 inches apart. The first year it was grazed off with sheep, which were borrowed for that purpose, as Mr. Hill had none at the time, care being taken not to crop it too close. The second year it was cut, and as Mr. Hill had not stock to eat it off, it was given to his neighbours. The crop is now being cut for the fifth time this year, each cutting yielding 2 tons of hay, which is made into a large stack. The lucerne is about 3 feet in height, and is being cut and fed to the milking herd of 150 cows, the animals receiving as much as they will eat. Since the lucerne was cut, just a fortnight ago, it has made over 6 inches of growth. The furrows are to be ploughed in to level the land, then disk harrows run over and across to cut as deep as they will go, and it is anticipated that the crop will be more than twice as thick afterwards. In Mr. Hill's opinion, the more it is split up, after being firmly established, the stronger and more thickly it will grow. *This is growing on rich river flats and without irrigation.*

It is a fine object lesson to dairy farmers, this being one of the driest seasons for over twenty years.

ENSILAGE AND ROOT CROPS.

The Editor,

Journal of the Department of Agriculture of Victoria.

Dear Sir,

I was interested in Dr. Howell's article on the Beet-sugar Industry of Victoria, and hope the industry may yet be established. I took some trouble, in conjunction with Mr. F. W. J. Moore, late Secretary of the Tasmanian Department, in trying to establish sugar beet here.

One great difficulty is in keeping up the fertility and condition of the soil, as in order to get clean well-forward roots the ground must be of very fine tilth and in good heart. In growing chicory I have found the best way to secure this is by growing some crop for ensilage as an alternative crop.

I have grown chicory for some years, and have better crops of cleaner roots than ever. As soon as the chicory is harvested, in May or June, I sow oats and peas with a little barley, and get a heavy crop, which is cut with the binder (for convenience in handling), and put into a trench silo, and as soon as the crop is cut I plough with double furrow. Every day is of importance, as if it is left for a week you can never get the ground in such fine order. We harvest the ensilage when full grown, but not turned colour, about the end of November or first week in December. The ground is occasionally harrowed, to keep down weeds, through the summer; and after winter rains, in July or August, it is ploughed up deep; and in end of September or beginning of October the chicory is sown. We can always get the ground ploughed up fine directly the crop is cut, and the ten months of fallow gets the ground in the best possible condition for root crops; and in a dairy district the ensilage is the best and cheapest fodder we can grow, and no other crop can be cut so early in the season and take less out of the ground.

I don't know if any of your farmers have tried this plan; if not, I think it well worth a trial, to prepare the ground with least trouble and less expense for manure.

Yours sincerely,

W. E. Shoobridge.

Bushy Park, Tasmania, 9th April, 1902.

VITICULTURAL BRANCH.

RELATIVE MERITS OF CEMENT AND WOODEN VATS IN WINE-MAKING.

By R. Dubois, B.Sc.

(*Continued from page 32.*)

Several new processes in the art of building fermenting vats have recently been introduced on the Continent and in Algeria. These may prove of interest to wine-makers here, and be adopted with advantage.

The new structures, known under the names of *sidro-cement* or *Monier concrete*, consist in the use of interlacing iron rods embedded in cement, mortar, or concrete.

The binding together of two materials having such widely different properties would seem at first abnormal, but a close study shows that they can be combined, and that their judicious use offers many advantages.

The co-efficient of expansion of cement differs only very slightly from that of iron. It is owing to this fortunate coincidence that Monier cement and concretes have been so successful and lasting, as the difference in the expansion of these two materials would cause the whole structure to crack and soon fall to pieces.

The adherence of cement on iron is very considerable, and may be compared to the coherence of the component parts of concrete, that is to say, the *aggregate* and *matrix*. The oxidation and rusting away of iron was at first feared, but practice has shown that iron embedded in cement is preserved indefinitely, and it has been proved by experiments that iron becomes coated with a silicate compound preserving it against any ultimate oxidation.

These facts show the possibility of combining iron and cement for the building of lasting structures.

We shall not study here the theory and calculations necessary for the establishment of Monier concretes. Those interested in the subject will find detailed particulars in special treatises.*

A rough outline of the theory will suffice to help us to understand the principle upon which rests this mode of construction. It is well known that cement concrete offers a high compressive strength, but little tensile strength, the latter being only one-tenth of the former.

* *Les celliers*, by Ferrouillat and Charvet, Montpellier; *Le ciment armé*, by Boileau, in Journal de l'architecture, 1897; also in Génie civil, 4th, 11th, 18th, 25th February, 1899, by Considéré.

If we consider a solid A.B.C.D. (Fig. 1) resting upon two bearing blocks, E.F., and a load acting normally to its horizontal axis and observe the deformation taking place, we notice that the top part, A.B., becomes shorter (compression), while the lower part, C.D., becomes longer (tension) (Fig. 2). If this solid is made of cement concrete alone it will offer a very small breaking strain on account of the large difference between the tensile and compressive strain of cement.

Now, if a sufficient number of iron rods or wires are embedded in the bottom of this solid, so that the tensile strength equals the

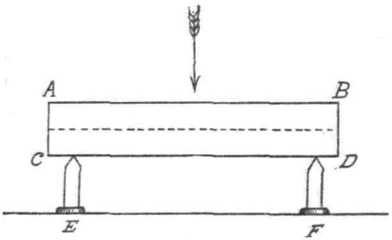


Fig. 1.

compressive strength, and if, on the other hand, we take the necessary proportions to resist the sliding and shearing strains so as to prevent

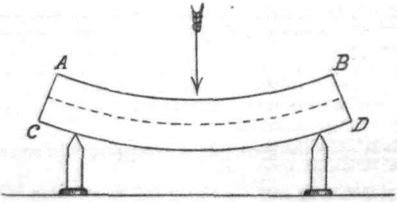


Fig. 2.

dislocation, we shall have constructed a solid answering the theoretical rules of resistance to deflection.

In the theoretical calculation the iron alone is considered to resist the tensile strain, so that the cement which covers the whole iron frame and has a certain tensile strength contributes to the strength of the whole structure. Systems vary with each builder, but the principle remains the same, and a general study will show the great interest this process of instruction may have for wine-makers.

The different systems may be arranged in two main groups :—

1st. *Monier Cement*, consisting of interlacing iron rods embedded in a rich cement mortar of small thickness, and called after the name of its inventor, Monnier,* who first applied it to construction in 1860.

2nd. *Cement and Iron Concretes*, composed of cement concretes surrounding thick iron or steel rods of calculated sections and disposed differently, according to inventors, of which Hennebique is the prototype.

Cement and iron cretrete or betons are more lasting than Monier cements. Slow setting cements† are used in their constructions. These cements become harder and more lasting with age. Whether used on horizontal surfaces (floor) or vertical surfaces (walls) the cement concrete has to be rammed on the surface of the floor or between a casing, and slow-setting cement must be used, that is to say, cement not setting under five or six hours, in order that the concrete may be got into place before setting has begun. Otherwise the half-set concrete would be disturbed, and its coherence impaired. Monier cement on vertical walls is generally erected by throwing the mortar with a trowel against the iron frame. It is handier in this case to use quick-setting cements, as the men have to wait until the cement first thrown upon the wire frame sets before they can add a new coat. This is certainly a weak point, for quick-setting cement loses its coherence with age and its chemical composition varies between wide limits. This accounts for some of the accidents recorded with fermenting vats made of Monier cement.

Monier concrete combines the advantage of great strength, economy in cost, and saving of space, and on the Continent it is used by agriculturists in many directions, such as aqueducts, water reservoirs, troughs, fermenting and storing tanks, &c.

The fermenting vats are made either cylindrical or prismatic in shape. Those made of Monier cement are from 2 to 3¼ inches in thickness, those made of concrete from 4 to 5 inches.

In both cases the frame-work is composed of vertical iron rods and iron circles secured together at intervals varying with the pressure the vat has to withstand. The concrete only serves to fill the spaces between the iron lattice-work.

In Algeria where this mode of constructing ferm‹nting tanks is most used, the cost varies between 2s. 6d. to 3s. 4d. per 22 gallons for small vats, and 1s. 8d. to 2s. 6d. for larger ones. This is only an

* It is usually written "Monier" in English works on engineering, although the name of the inventor is Monnier.

† Cement varies greatly in setting time—from five to several hours. The setting is generally retarded by aeration, for this slacks the calcium aluminate on which the initial setting depends. The setting of cement is ascertained by applying a standard needle, *i.e.*, a steel point of definite area loaded with a given weight. When the point ceases to make an impression the cement is considered set.

approximate cost, which naturally varies largely with the locality, the market value of the material, the proximity of sand and gravel, and the nature of the foundation required.

It is the custom in Algeria to cover the cylindrical vat with a semi-spherical top (*calotte*), and they are called *amphoræ* (Fig. 3). As

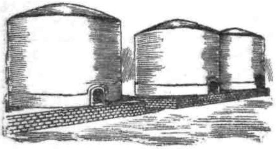


Fig. 3.—Amphoræ used for storing wine in Algeria.

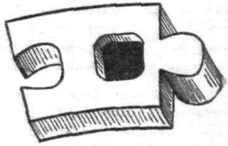


Fig. 4.—Special bricks used in the building of storage vats.

a rule these amphoræ have given good results, and the few accidents recorded must be accounted for through the bad quality of the cement used, or the use of cement not appropriate to this kind of work.

Amphoræ have also been constructed in Algeria with bricks made specially for that purpose. These bricks, shown in Fig. 4, interlock

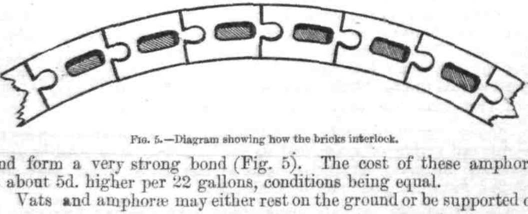


Fig. 5.—Diagram showing how the bricks interlock.

and form a very strong bond (Fig. 5). The cost of these amphoræ is about 5d. higher per 22 gallons, conditions being equal.

Vats and amphoræ may either rest on the ground or be supported on

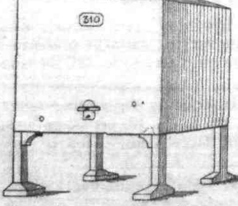


Fig. 6.—Storage vat resting on pillars.

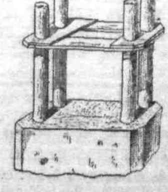


Fig. 7.—Showing mode of erecting pillars.

pillars, so as to render certain manipulations handier, and allow the space under the vats to be used for storing hogsheads, &c. (Fig. 6). The construction of the latter is similar to that of ordinary Monier cement vats,

but as the floor has to be suspended, its resistance is calculated as that of a surface carrying a load equal to the weight of wine in the vat. Each pillar rests on an iron and cement foundation, the horizontal area of which varies with the nature of the soil and the load. The section of each pillar is generally square; four vertical rods, one at each corner, are joined together at top and bottom by two sheets of plate iron, and embedded in the cement concrete (Fig. 7).* The compressive strain of the concrete, the height of the vat above ground, and the load are taken into consideration in the calculations.

The cylindrical vats are the cheapest if one considers only the cost of the vat. But if one takes into consideration the utilization of the whole of the space under roof, one notices that the surface is not completely utilized, as there are triangles left between the vats and walls which are completely useless. For this reason, Algerians prefer square vats, which, although costing more per gallon, are cheaper if

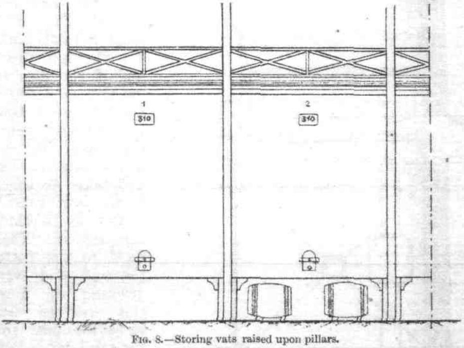


FIG. 8.—Storing vats raised upon pillars.

one considers the total cost of the fermenting house and appliances. Some contractors will build at a cost of from 5s. to 7s. per 22 gallons, the vats and the fermenting house.

Monier cement does not seem appropriate for this kind of construction, as the flat thin walls would not have the required resistance to deflection.

The iron and cement concrete is alone used for this purpose. When the vats are opened, an iron and cement belt is placed around the top, when they are closed, a vaulting is erected over the top. Open and closed vats may both be used for fermenting purposes, the latter are also used for storage. These may be raised upon pillars. (Fig. 8.)

They are generally built several together in a row, and, in this case, the top is utilized as a floor where trolleys may be established for

* Figs. 7 to 11 are borrowed from *Le Progrès Agricole.*

carrying the vintage (see attached plate), or as draining floors for the manufacture of white wines after the draining method. (Figs. 9 and 10.)

The cost of open vats in Algeria is 2s. 8d. to 3s. 4d. per 22 gallons; closed vats are built at a cost of from 3s. to 3s. 9d. per 22 gallons. If built on pillars the prices rise to 4s. 3d.

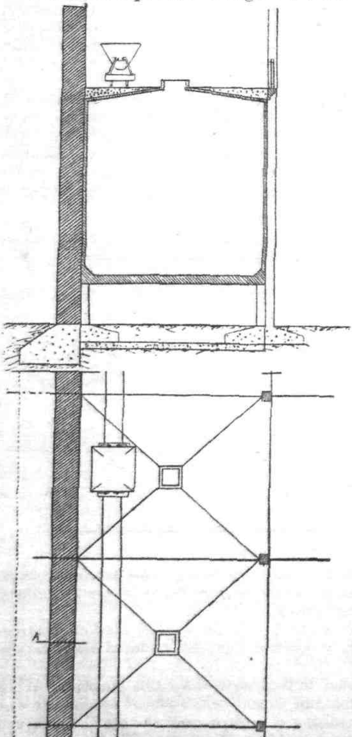


Fig. 9.

It is customary to place at the bottom of these vats a man-hole or door made of cast iron. The frame of the man-hole being joined with the iron frame work of the vat (Fig. 11). The marc is taken out of the vat through this door, and if the floor of the vat is 2 or 3 feet above the fermenting house, as is generally the case, the marc is emptied direct into the trolley and taken to the press. With open vats under 6 feet in depth, brass taps are used. These are fixed to the bottom of the wall, and serve for draining the must, in this case the marc is shovelled out through the top.

Special devices (brackets, ledges, reliefs, hooks, &c.) are built in course of construction to keep the head of marc submerged with planks or nets, as previously explained.*

We have in a previous article mentioned several coatings used for preventing the action of wine upon cement. Since then new facts have come under our notice which are worth quoting.

* *Journal of the Department of Agriculture*, No. 2.

Bouffard and Büring* made exhausted experiments from which it results that slow-setting cements have many advantages over quick-setting cements for the storing of wine.

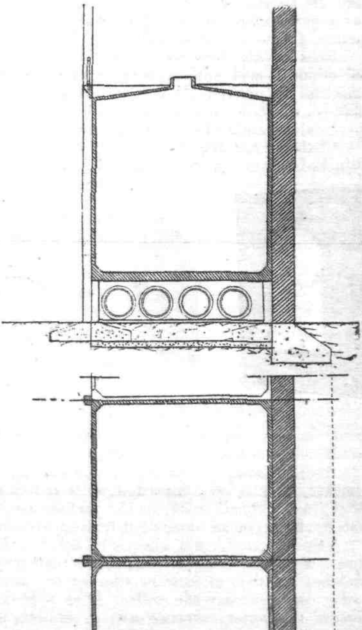


FIG. 10.

"Quick-setting cement always contains a large amount of free lime, which acts upon the wine, diminishing its natural acidity, modifying its taste, which becomes earthy, and causing to become flat and liable to diseases. Slow-setting cement contains less lime, especially when mixed with siliceous sand (quartz) previously washed with sulphuric or hydrochloric acid, and are almost without action on the must or wine.

These new facts are in favour of slow-setting cement for wine tanks. However, even in this case it is advisable to wash the inside walls with a weak acid solution." †

The coating generally used in the South of France is silicate of potash applied in the following manner :— A solution of silicate of potash 25 parts and water 75 parts, is applied with a brush. After three or four days, when completely dry, the walls of the vat

* *Progrès Agricole* 1898, Vol. XXX.

† It is an error to believe that slow-setting cements are poorer in lime than quick-setting cements. The latter are natural cements, containing 40 to 65 per cent. of lime. *This amount, however, varies largely with different specimens*, and this is *one of* the weak points of quick-setting cements. The former are generally artificially manufactured, and contain, according to the maker, from 58 to 63 per cent. of lime. The

are washed with a quantity of pure water. When they are dry, a second coating of 50 parts of silicate of potash and 50 parts of water is applied and left to dry for a few days. The vat is again thoroughly washed with pure water. A coating of silicate of lime very resistant to the action of wine is thus formed.

Roos has also tried a solution of 10 per cent. of tartaric acid instead of sulphuric acid, applied twice in 24 hours before using the vat. In this case the protective coating of tartarate of lime, insoluble in must, is formed, which is without action whatever on the wine, and, according to the above authority, no coating yet experimented upon equals this.

Chabert* has studied the action of cement which has been already attacked by must in full fermentation. A small cube of cement was washed in a solution of 5 per cent. sulphuric acid and immersed in a liter of fermenting must. The loss of acidity of the wine after fermentation was in this case 1·09 grammes. It was then scrubbed with a brush and water, and immersed a second time in must in full fermentation. The loss of acidity was in this case only 0·10 grammes. It was washed again, immersed in must in full fermentation, and left 50 days in the wine. It was then found to be without effect on the wine. In the pores of the cement could be seen very small shining crystals of tartarate of lime, which could not be removed by scrubbing.

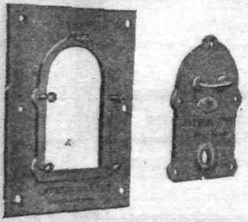


FIG. 11.—Frame of man-hole and door.

Another reason in favour of slow-setting cement is that it never cracks. This is very important, as it is very difficult to mend a vat that leaks. Small cracks on the surface are easily filled with mutton fat, but large cracks going right through are almost impossible to mend.

Cement vats should always be filled with water before they are used, if it were only to make sure that they do not leak. Damp patches are then often to be seen on the outside, and sometimes the water oozes through the walls. After a while, however, the evaporation of this water, carrying salts in solution, produces a deposit which closes the pores, and the walls become quite watertight.

(To be continued.)

difference in the percentage of lime is therefore not very considerable. But what analysis does not show is the shape under which the lime and other matters are contained in the cement. This is so true that a same limestone can yield, by proper burning, a cement which will set in five minutes, or, by longer burning, a cement which will require several hours to set.

Artificial Portland cements owe their slow-setting property to an excess of burning determined by experience. Artificial cements have the advantage of having a constant composition, as the different materials are measured before burning. It is this great regularity of composition and the way they are manufactured which insure the lasting properties of constructions.

Roos has also proved, by experimenting with siliceous and calcareous sands, that the nature of the sand has but little effect on the wine. This is, no doubt, due to the sand particles being coated with a protective layer of cement.

* *Progrès Agricole*, 1900, Vol. XXXIV.

NURSERY OF MOTHER STOCKS TWO AND THREE YEARS OLD.

VITICULTURAL BRANCH.

SECOND PROGRESS REPORT OF THE VITICULTURAL WORK OF THE STATE OF VICTORIA FOR THE YEAR 1901.

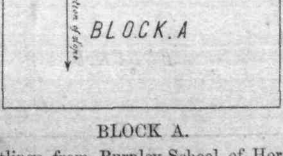
By the Director of the Viticultural Station, Rutherglen.

American Stocks at the Viticultural Station.

One of the objects of the Viticultural Station is to investigate which American phylloxera-resistant vines are likely to give the best results under local conditions, work for which private vine-growers cannot afford either time or means, and to make the results of these experiments known to those interested by means of periodical publications.

It also undertakes the propagation of selected stocks for distribution among growers, and will this year graft American stocks on a large scale.

With these objects in view, the first plantation of American stocks was made in August, 1900, from 2,992 vines, selected from the stocks growing at the Burnley School of Horticulture. These were planted out at a distance of 6 ft. x 4 ft., on a slope facing the south-east, covering an area of a little over 1½ acres. The land was subsoiled to a depth of 18 inches. The strike was good, varying between 75 and 100 per cent., according to species. The few blanks were filled up in August, 1901, and the whole block trellised in October. This trellis is 5 feet high, with four wires 15 inches apart, and, as may be seen from the accompanying photograph, is well covered. The average length of the main shoots is given in the following table, which also shows the actual number of plants now growing.



BLOCK A.

American rootlings from Burnley School of Horticulture, planted out in August, 1900.

Trellised in October, 1901.

Distance apart—6 ft. x 4 ft.

Soil—Virgin, yellow and white clay, very difficult to work, setting like cement.

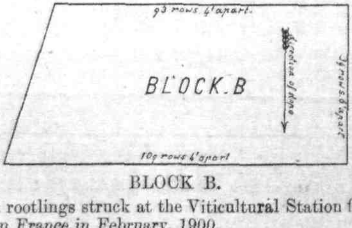
Cultivation—Land subsoiled to 18 inches with ploughs.

Manuring—Blue peas between the rows as green manure.

—	Number of Plants.	Average Length of Shoots.
		feet.
Riparia Grand Glabre ...	665	7
,, Portalis	295	7
,, x Rupestris ...	50	7
Couderc hybrid, No. 3,306 ...	33	7
Azemar	59	5
Couderc hybrid, No. 101-14	16	7
Cordifolia de Grasset ...	18	4
,, x Riparia ...	81	7
Rupestris du Lot	36	5
Azemar	10	5
Rupestris Mission	12	7
,, Metallica (France)	239	7
,, Metallica (Cape) ...	180	7
,, Ganzin	258	7
,, du Lot	188	6
,, Martin	794	5
Total	2,934	—

It is estimated this block (Block A) will yield this year over 200,000 strong cuttings, one foot long, and over ¼ inch in diameter. 100,000 will be kept at the Station, and grafted on the bench this winter, planted in nursery rows next spring, and available for sale as grafted rootlings during the spring of 1903. The balance, about 100,000, will be available for free distribution this spring.

In August, 1901, two other blocks were planted out with young rootlings, struck in the nursery the previous year, the largest portion of the cuttings being those imported from France in February, 1900. The two following tables give the detailed particulars of the number of plants actually growing in these two blocks, the average length of the shoots of each variety, and the percentage of strike.



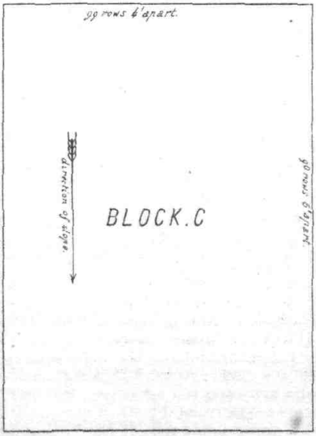
BLOCK B.

American rootlings struck at the Viticultural Station from cuttings *imported from France in February, 1900.*

Date of planting—August, 1901.

Distance apart—6 ft. x 4 ft.
Soil—Virgin, same as Block A.
Cultivation—Land subsoiled to 18 inches with ploughs in 1900.
Manuring—Complete chemical manuring.

—	Number of Plants.	Average length of Shoots.	Percentage of Strike
Riparia Grand glabre ...	167	1½ feet	91
,, Gloire	553	3 ,,	96
Couderc Hybird 3,306 ...	984	3½ ,,	97
,, 3,309 ...	1,035	3½ ,,	97
Rupestris du Lot ...	321	3 ,,	98
,, Martin ...	321	2½ ,,	96
Total ...	3,381	—	—



BLOCK C.

American rootlings struck at the Viticultural Station from cuttings imported from France in February, 1900, and from one-eye cuttings selected from the Burnley stocks.

Date of planting—August, 1901.
Distance apart—6 ft. x 4 in.
Soil—Red loamy clay, rather friable, with patches of stiff white clay at bottom of hill, and outcrops of quartz at top.

Cultivation—Land subsoiled to 14 inches in 1901 on the site of a three years' old vineyard of shiraz, the land having been trenched to 18 inches in 1897.

Manuring—*Complete chemical manuring.*

—	Number.	Average Length of Shoots.	Percentage of Strike.
Riparia Portalis	661	2½ feet	95
,, Grand glabre ...	1,212	3 to 4 ,,	94
,, Gloire	758	3 ,,	96
Couderc hybrids, No. 101–14	49	2½ ,,	94
,, ,, 101–14	70	2½ ,,	70
,, ,, 1,202	185	3 ,,	93
,, ,, 3,306	770	3½ ,,	97
,, ,, 3,309	192	3½ ,,	97
,, ,, 3,306	75	3 ,,	75
,, ,, 3,309	92	3 ,,	92
,, ,, 101–14	85	3 ,,	85
Aramon x Rup. Ganzin ...	65	2½ ,,	66
Rupestris Metallica ...	1,023	3 ,,	94
,, Martin	661	2½ ,,	95
,, Ganzin	1,261	1½ ,,	85
,, du Lot	990	9 inches	100
Total ...	8,149	—	—

Block B, which may be seen in the foreground of the accompanying photograph, is planted out on the same slope as Block A; the soil is of a whitish clay nature, and very difficult to work. The land was prepared to a depth of 18 inches.

And we have here a striking illustration of the advantage of deep preparation, as the growth and strike are both very satisfactory, considering the long spell of dry weather we had this summer.

Block C is planted on rather better soil, a friable red loam, with patches of white clay and outcrops of quartz sloping towards the east. The three above tables are made up, starting from the top of the slope; for instance in Block C, Riparia Portalis is on the top of the block, and Rupestris du Lot at the bottom. The soil gradually improves from bottom to top in the three blocks, but is very patchy, and nowhere would it be called a first-class soil for vines. However, this is rather an advantage from an experimental point of view, as if American vines can be successfully grown in the soils of the Viticultural Station, they can *a fortiori* be grown anywhere in the Murray districts.

Blocks B and C will be trellised this winter like Block A. When the blanks are filled up, this will make a total of 15,336 trellised American mother stocks, covering an area of about 9 acres, from which we will derive, in years to come, the cuttings required for reconstituting the areas destroyed by phylloxera. They will yield next year 1½ million cuttings fit for grafting on the bench. It is very improbable that the demand will exceed this, judging from the number of applications received in 1900 and 1901.

Distribution of American Stocks.

Distribution in 1900.

Cuttings and rootlings of American vines were distributed during August and September.

The following circular was sent to each of the 97 applicants :—

Sir,

I have the honour to inform you that the Minister of Agriculture has decided to distribute, free of cost, phylloxera resistant vines or cuttings, as available, in proportion to the area of vineyard of each applicant, on condition that land has been properly prepared, *to the satisfaction of the superintending officer, to receive them either for the* nursery or otherwise.

I shall therefore feel obliged by your informing me as to the area you have under vines, and the steps taken to prepare the land for planting resistant vines.

Sixty growers having complied with the required conditions, were furnished with vines. We despatched 110,467 cuttings, and 5,091 *rootlings, making a total of* 115,558 *plants. The following table shows* the number of each variety distributed :—

TABLE A.

Vines Distributed in 1900.

Rupestris du Lot	16,255	Couderc hybrid, No. 3,306	9,622
,, Martin	22,411	,, ,, No. 3,309	13,675
,, Ganzin	1,008	Solonis	15
,, Metallica	758	Azemar	71
,, Mission	47	Cordifolia x Riparia	129
Riparia Gloire	22,375	Cordifolia x Rupestris	50
,, Grand Glabre	27,300		
,, Portalis	1,841		115,558

Distribution in 1901.

The free distribution of cuttings and rootlings was resumed during July-August, subject to the same conditions as in *1900*, with this difference, that vine-growers having phylloxera-attacked vineyards were considered first.

We received 109 applications, and considered 76. We sent away 100,744 cuttings, and 47,000 rootlings, making a total of 148,744 *plants. The following table gives the numbers of each variety dis*tributed :—

TABLE B.

Vines Distributed in 1901.

Rupestris ordinaire	180	Couderc hybrid, No. 3,306	11,500
,, du Lot	39,100	,, ,, No. 3,309	4,850
,, Phenomene	4,600	,, ,, No. 101–14	2,000
,, Martin	28,370	Aramon × Rupestris Ganzin	2,341
,, Ganzin	6,050	Varied	488
Riparia Gloire	32,700		
,, Glabre	8,665		148,744
,, Portalis	7,000		

The distribution was completed on the 7th August, in much better time than in 1900, when it was only started on the 17th August. The mother stocks being very young, the cuttings were small. However, they were in perfect order, and wherever water was available, as in the Ardmona Irrigation Colony, for instance, the strike was very successful, notwithstanding severe frosts experienced during spring. In the drier districts, where the young plants could not be watered, a large percentage was lost. They all started to grow, the rainfall of September

and October being greater than usual. But the dry weather setting in suddenly in November, caused a great many to die, as the small cuttings had not enough reserve matter to draw on.

TABLE C.

AMERICAN VINE CUTTINGS PLANTED IN NURSERY ROWS IN 1901, AVAILABLE FOR FREE DISTRIBUTION AS ROOTLINGS DURING THE COMING SPRING:—

Riparia Gloire	2,455	Couderc hybrid, No. 1,202 ...	37
,, Portalis	661	,, ,, 101–14 ...	60
,, Grand Glabre ...	1,666	Azemar	40
,, x Rupestris	11	Aramon x Rup. Ganzin ...	63
Rupestris Martin	1,729	Cordifolia x R. Ganzin ...	18
,, du Lot	2,474	,, Grasset	5
,, Metallica	86	Rupestris x Cordifolia ...	15
,, Ganzin	56	Riparia Gr. Violet	22
,, Mission	7	Solonis	33
Couderc hybrid, No. 3,306 ...	1,025		
,, ,, 3,309 ...	1,374	Total	11,857

Besides these, 100,000 cuttings 1 foot in length will be available for distribution, as stated above.

Conclusions.

Had we a large water supply at command, as is the case with the New South Wales Viticultural Station, established on the Murray bank near Howlong, we would have five times the quantity available for distribution and grafting.

For bench-grafting the cuttings must be strong with a good thick under-bark and plenty of sap, and this cannot be obtained without water. We are one year in advance of New South Wales in regard to propagating American vines, but Howlong has a great advantage over us—they have a splendid irrigation plant. Here we have none, and propagation of young stocks without water, in a district like Rutherglen, becomes a very difficult task.

The following printed letter was sent to each successful applicant:—

SIR,

This day a parcel of American resistant vines addressed to you has been despatched from this Station by rail to . .

To insure a successful strike of the cuttings, it is desirable that they should be planted in a carefully-prepared nursery bed, where they can be given such attention as they require.

If not planted immediately, both rootlings and cuttings should be placed in sand to prevent injury by exposure.

Kindly acknowledge the receipt of the parcel.

Will you be good enough to furnish a report, in due season, stating the percentage of strikes and any other particulars.

The varieties and number sent are as follows:—

	Rooted.	Cuttings.

I must have the pleasure of expressing my obligations to those who in answer to this letter have had the kindness of sending reports on the progress of the young plants and remarks as to their growth. The viticultural industry as a whole is deeply indebted to them for the great trouble which they have taken, and for the valuable aid thus received.

It is by co-operating in this manner, by compiling and discussing the observations of those interested, that sound conclusions will be arrived at. Besides this, a list of the growers to whom vines were given, is kept at the station. They are visited from time to time by the director or some member of the inspectoral staff, and the material and data obtained are studied together with the data of our seven district experiment stations. It need hardly be said that the definite characterization of a vine with regard to its adaptation to soil and surrounding climatic conditions cannot be the work of one or two years, even in a single locality. Seasons vary every year, so that until a sufficiently large number of observations can be brought into the calculation of averages, it is impossible to arrive at valid conclusions. The publication of records of 1900 and 1901 will be deferred, as if these are taken as indicating established averages, they will lead to injudicious investments on the part of too eager growers. In all agricultural experimentation the experience of a number of years taken together, and properly discussed, is absolutely essential to the safety of the conclusions drawn.

The necessary investigations of resistant vines under local conditions, their adaptation, propagation, grafting affinity, must of necessity absorb several years.

It is for this reason that, notwithstanding the persistent misrepresentations that have from certain quarters been heaped upon the work and those participating in it, it has been steadily pursued, substantially on the original plan, with such modifications as experience suggested, and will continue so long as the present director shall have power to uphold it. Being without precedent, for the simple reason that similar questions have never been presented for investigation in Victoria before, great difficulties have had to be overcome, and are still before us. It is only two years ago since the first American stocks were planted in the various vine districts of this State. They have only been studied during two seasons. Our oldest mother stocks are only three years old, and grafting on a large scale has not yet been undertaken. A few more years and we shall be able to place before the vine-grower definite conclusions for every district. In the meantime, those who are eager to reconstitute, will have to act according to the results obtained in climates corresponding to ours, South of France, and California; the experience and practice of those countries must be their guide.* We cannot for the present give any further advice.

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* Foëx concludes his chapter on the "Choice of American Vines," in his work *Manuel Pratique de Viticulture* with the following remarks, which are the outcome of 30 years' practice in that country, which has the largest areas of phylloxera-resistant vineyards:—

"To sum up, the following is a list of the soils in which certain American vines may succeed:—

1st. Fresh, fertile, deep soils, containing less than 25 per cent. of limestone: *Riparia Gloire de Montpellier*, and *R. Grand Glabre*.
2nd. Fresh soils but slightly fertile, and of little depth, clayey, containing less than 25 per cent. of limestone: *Rupestris Martin*.
3rd. Clayey soils, not too damp or not too pebbly, poor, containing up to 40 per cent. of limestone in the south and 25 per cent. in the west of France, or up to 80 per cent. in certain well-drained tufas: *Rupestris du Lot*.
4th. Clayey soils more or less damp, containing up to 40 per cent. of limestone: *Riparia × Rupestris, No. 101-14, 3,306, 3,309*.
5th. Calcareous soils of a chalky nature, pulverized white marl, &c.: *Berlandieris*.
6th. Salt soils, or *pourridié* soils: *Solonis*."

Monographs of these cépages, with photographic illustrations, will be given shortly in this Journal.

Viala, in his world-renowned work *Les Vignes Américaines,* makes the following statement:—

> In clay-siliceous or siliceous clay soils, or those only containing a small quantity of limestone, all American vines resistant to phylloxera can be successfully cultivated. However, they show in their growth, fructification, &c., certain differences which must be taken into account. Not that in soils of this nature they would be a complete failure, but, as the creation of a vineyard actually necessitates a large expenditure, it is important to know the character and aptitude of each, so as to cultivate only those giving the best results.

Fortunately for Victoria, the largest vine areas are on clayey and siliceous soils, so that by planting selected varieties of Rupestris and hybrids of Riparia and Rupestris, which are very resistant to phylloxera and vigorous, we may venture to say that the results will be successful. Although we must bear in mind that for a given soil, there is one variety that will do better than any other. Local experience alone will enable us to find out which it is.

With regard to California, the most up-to-date information obtainable is contained in a Bulletin issued by the University of California, and entitled *Bench-grafting Resistant Vines,* by F. T. Bioletti and A. M. dal Piaz.

THE CONTINUOUS WINE-PRESS.

By R. Dubois, B.Sc.

Several correspondents having asked us for a description of the continuous wine-press now in use in Victorian wine cellars, we extract the accompanying illustration from Roos' "Wine-making in Hot Climates." *Fig. 1 represents a single screw-press, and shows its* simplicity and the working of its component parts. This continuous press is constructed with the object of dealing quickly with a large quantity of grapes and securing the complete extraction of the grape-juice in one single operation.

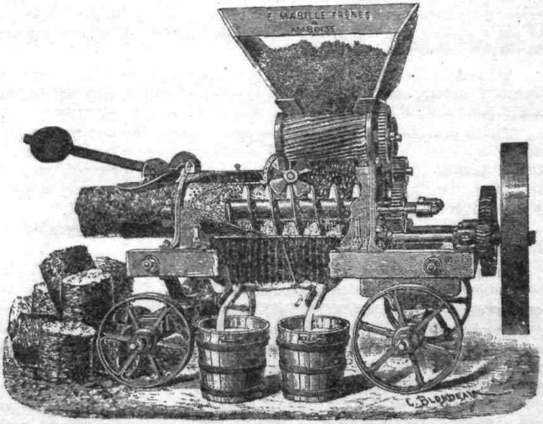


FIG. 1.—MABILLE'S CONTINUOUS PRESS.

By means of this press, it is possible to obtain, from red grapes the first white juice of the tint required, and complete extraction of the must from the marc of fresh or fermented grapes.

The mechanism consists of two cast-iron rollers forming the crusher, under which a cylindrical casing of perforated brass sheets is fixed horizontally; an endless screw or worm revolves in this casing.

The perforated casing is closed at one end by a hinged door, which is maintained in position by means of a lever, provided with an adjustable balance-weight.

The portion of the cylindrical casing between the end of the worm and the adjustable door forms the compression chamber. The grapes having first been crushed, are carried by the endless screw towards the

compression chamber, in which the marc is agglomerated and compressed until it constitutes a mass of sufficient hardness to raise the door and the balance weight. This agglomerate is then slowly forced out in a perfectly dry state.

A special contrivance allows of the lever remaining in a horizontal position whilst the door is being raised. Once the agglomerated mass has been formed, the degree of compression or dryness is regulated at will by adjusting the balance-weight.

The must is collected into a trough fixed underneath, and running the whole length of the machine.

The trough is divided into two compartments by an adjustable partition, by means of which the juice from the first process of extraction, which makes the finest wine, can be separated at will, from that resulting from the latter pressing. In the production of of white wines from red grapes, the second grades of juice, which are too highly coloured, are separated.

All risks of choking owing to the crushed grapes being carried forward through the rotary motion of the screw are obviated by the adaptation of a rotary disc.

This is provided with webs which gear into the thread of the worm as the latter revolves and effectually intercepts the crushed grapes in that direction. The solid portions are thus forced forward (being at the same time pressed and drained) into the compressing chamber, where the pressing is completed.

The must coming out of the draining and compressing chamber is free from pips, skins, and mucilaginous matters.

The press is worked by a gearing clamped on the horizontal shaft of a pulley driven by a steam-engine, another set of gearing works the crusher.

The opposite thrust of the action of the screw, and of the perforated casing is counteracted independently of the frame of the machine, by means of two long bolts connecting the end of the screw with the compression chamber.

By removing the two crushing rollers, the press may be used for pressing fermented marc, or in this case the rollers may simply serve as feeders.

The chief feature of this press is the simplicity of its organs. It does not require any special knowledge to work it. Hinged doors are provided on either side to enable the attendant to superintend the inner working while the machine is in motion.

Crushing rollers, screw, and rotary disc, may be easily taken out, and the whole machine can be quickly taken to pieces and cleaned.

Two sizes are in the market, the No. 2, which works approximately one ton of fresh grapes per hour, and the No. 3, which works two tons. Both these presses should be worked at from 70 to 80 revolutions per minute. They are liable to choke if worked quicker, and the marc does not drain properly. The feeding must be done very regularly, if not the

machine will not work at all. It is, therefore, advisable to attach a little elevator, which will carry the grapes or marc regularly into the hopper.

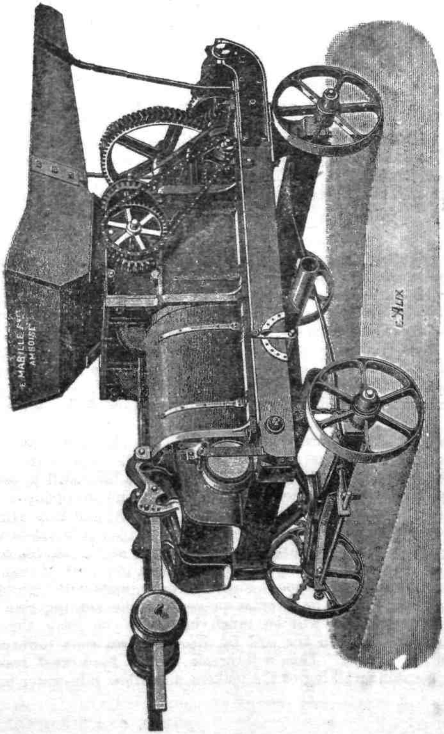


FIG. 2.—MABILLE'S CONTINUOUS PRESS, WITH TWIN SCREWS.

Mabille also makes a larger press with twin screws, working from three to four tons of fresh grapes per hour. (See Fig. 2.)

SEASONABLE WORK IN THE CELLAR AND VINEYARD.

By R. Dubois, B.Sc.

May.

Cellar.

Casks containing new wines should be filled up every three or four days. New wines should be watched carefully and tasted every week, as they may turn when silent fermentation is over, or, in some cases, develop bad tastes due to the cask. In the former case, rack into a sulphured hogshead or sterilize, in the latter, rack into a clean cask. Continue racking, fining, and bottling of old wines as during last month.

Vineyard.

This is rather a slack month in the vineyard, as it is yet too early to proceed with the pruning. A few other important operations may, however, be started this month; the filling up of vacant spaces in old vineyards—by layering, as explained elsewhere in this issue, the erection of trellis for varieties such as Cabernet, Shiraz, Malbec, which bear better on long rods (*taille de quarante*), the driving of stakes, &c. If the vineyard is one or two years old only, rootlings can be used later on to replace the "misses."

Trenching or subsoiling for new plantations should be started this month.

Do not turn horses, cattle, or sheep into the vineyard; this purely Australian practice does more harm than good. The leaves which have often been compared to the lungs of the vine have still to perform the very important function of elaborating and restoring soluble matters to the wood to enable it to ripen properly, and thus render it fit to grow strong shoots next spring. Badly ripened wood produces weak shoots carrying but little crop. As long as the leaves remain green they are useful to the plant, and if you allow cattle to eat them down you injure future crops. Further, the animals will trample the damp soil and form a hard crust preventing the autumn rain from soaking through. It will be much better if you have time and teams to spare to open the soil by throwing two sods towards the centre of each row. This will break up the hard crust resulting from the constant walking of the pickers, and allow rain-water to soak down.

LAYERING VINES.

By G. Foëx, Inspector-General of Viticulture, France.

TRANSLATED BY

*R. Dubois and W. P. Wilkinson.**

Propagation by Layers.

Layering consists in inducing the growth of roots on a cane before it is separated from the mother plant. This method, which, like propagation by cuttings, preserves all the characters of the mother plant and even those of the cane, offers the advantage of better insuring the strike of the young plant, as it is only separated from the mother stock when it is provided with all organs necessary to its existence. Therefore it should be preferred, although rather complicated, for species not rooting freely, such as *V. Candicans* and *V. Berlandieri* or for rare and expensive cépages. We will study successively the following items :—1st. Types of layers. 2nd. Means of promoting their root growth. 3rd. Best time for layering.

1st.—Principal Types of Layers.

These are :—A. *Ordinary layering;* B. *Complete burying of the mother plant;* C. *Multiple layering;* D. *Reversed layering.*

(A.) *Ordinary layering.*—This may be used for the production of rootlings, filling up a vacant space in a vineyard, liberating an American variety grafted on a European vine, or for rooted nodes used as stock for bench grafting. When rootlings alone are required, a portion of the cane is buried underground as close as possible to the mother plant, leaving two eyes projecting from the soil at a certain distance from it. All the intermediate buds between the mother plant and the point where the cane enters the soil are removed, to prevent the development of shoots at the expense of the layer. The part in the ground must be as short as possible so as to save wood and use the extremity as a cutting, and also to avoid the formation of a great number of tufts of roots, with small individual development.

This layering may be done with lignified or herbaceous shoots. In the latter case we gain time as we obtain rootlings the same year; when such rootlings are to be transplanted, it is necessary to prune them before planting out, so as to leave only two tufts of well-constituted roots. These acquire much larger size than if they had all been allowed to remain on the rooting.

Ordinary layering can also be adopted for filling up vacant places in an old vineyard, or for liberating American canes grafted on European vines. In both these cases the layer has to remain in the

* Extract from *Manuel pratique de Viticulture pour la reconstitution des Vignobles Miridionaux.* Montpellier, 1899.

place where it is performed. Its execution is shown in Fig. 1; after having dug out the dead stump and carefully removed all the roots, a trench is opened between the mother plant and the place where the dead vine was growing; this trench is deep enough to allow the ploughing to be performed in the vineyard without touching the cane (about a foot). A cane sufficiently long is selected in such a position as not to alter the shape of the mother plant after it is cut away. It enters the soil as close as possible to the mother plant, is buried at the bottom of the trench, the extremity turned up vertically and tied to a stick, leaving two buds free above the ground. The trench is filled with mellowed soil well rammed against the cane.

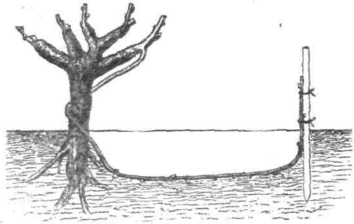


Fig. 1.—Ordinary layering.

Manure is often put into the trench so as to promote the development of roots. However, it seems preferable to manure only the mother plant the first year, and to manure the layer after it has been separated from the mother plant. One avoids in this way a growth of roots from the mother plant towards the trench, which would withdraw assimilable matters before the layer had time to produce roots large enough to allow it to compete.

When the cane is not long enough to reach the place where the young plant is to be established, successive layers may be resorted to, or the grafting of another cane by the whip-tongue system, the layering being performed in the usual way.* Further, it is possible, with the layering method, to change the nature of the vine by grafting a cane from another cépage.

The ordinary layers made in the vineyard are generally separated from the mother plant when two years old. If this operation is done earlier it produces a check in the growth, diminishing the fructification. In certain parts of the valley of the Rhône this method is used to replace a "miss" by a cane of European vine grafted on an American plant. If the graft is well knitted, and if the roots are carefully removed during the two first years, those growing on the European cane are quickly destroyed by phylloxera, and the new plant lives at expense of the American graft bearer. It goes without saying that in this case the layer must not be separated from the mother plant. This method also enables the nurserymen to obtain a great number of rooted eyes by lifting canes buried during the spring. These rooted fragments or rooted nodes may be grafted with every chance of success. (Champin method.)

* We may also mention Hardy's system of training the layering shoot along a stake as described in "*The Australian Garden and Field*," 1901. [Transls.]

(B.) *Complete burying of the mother plant.*—This method may be used to replace "misses" in a vineyard, or to liberate American vines grafted on European stumps. It is generally considered as inferior to all others; it yields plants of little vigour and very short life. This is the result of the bad distribution of the root system, partly grown on the old wood, and spread over too great a length of cane. Further, it is more expensive than the above. It should only be used when we wish to obtain several plants from a single mother plant, in which case it is better than any other.

These layers are made in the following manner (Fig. 2):—A deep trench is formed reaching from the mother plant to the spot where the new plant is to grow; the main roots of the stump are cut away to allow it to bend down without breaking; two canes selected for the purpose are brought down and buried at the bottom of the trench, allowing the two extremities to project out of the ground, one in the place where the new plant is to grow and the other in the place where the mother plant was; manure is then added, and the trench filled with mellowed soil. By making trenches radiating from the old stock it is possible to establish many new plants by the layering several shoots from a single stock.

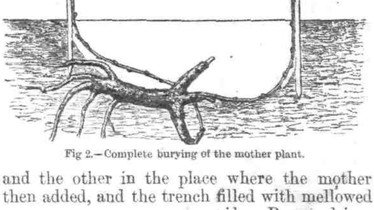


Fig 2.—Complete burying of the mother plant.

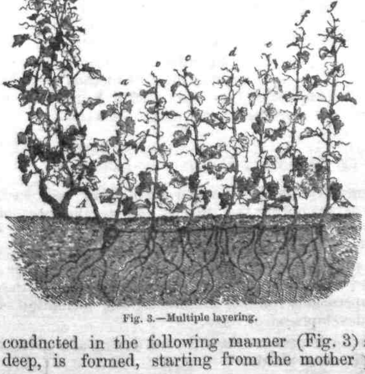


Fig. 3.—Multiple layering.

(C.) *Multiple layering.*—The multiple, or *Chinese* layering, is used to obtain rootlings, and offers the advantage of allowing these to be raised in one season, that is to say, in the time usually necessary to obtain one cutting, and this without wasting any wood.

The operation is conducted in the following manner (Fig. 3):—A trench, 10 inches deep, is formed, starting from the mother plant; a cane, selected

for the purpose, is stretched at the bottom of this trench, and kept in position with little pegs at a depth of 2½ to 3 inches. All the buds between the old stock and the place where the cane enters the ground are removed; when vegetation starts each bud develops, and as soon as they reach 6 to 8 inches the trench is carefully filled with soil mixed with manure and sand if the soil is naturally stiff. When it is not naturally moist the surface should be covered with mulching. Numerous roots develop on the cane at the base of each shoot during summer, and when the time for planting out has arrived the cane is unearthed and divided between each node, forming so many healthy rootlings.

This practice may be considered as the most practical and the most economical for multiplication of species rooting with difficulty, such as *V. Candicans* and *V. Berlandieri.*

(D.) *Reversed layering.*—Reversed layering may be used for replacing "misses," or for establishing an American rootling by means of an American scion grafted on a European stock. A cane (Fig. 4) is selected on the mother plant, its extremity bent and driven down in the ground to a depth of 8 to 10 inches, the soil having been dug up and manured. All the buds between the mother plant and the soil, except those two nearer the soil, are removed. Rooting takes place within a year, and it is cut from the mother the following year. Strange as it may seem, no ill effects result from the turning upside-down of the stem of the young vine which this process entails, the young vine is well constituted, and even bears fruit the very year the operation is performed. To sum up, this method may be considered as superior to any other, its only faults being that it prevents cross ploughing, and requires a great length of wood.

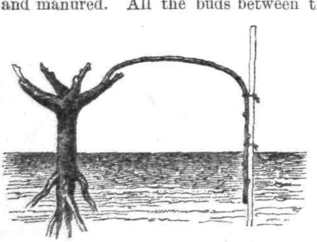


Fig. 4.—Reversed Layering.

2nd.—Means of Promoting Rooting of Layers.

Although layers generally root freely when planted in mellowed, moist soil, some means of promoting the growth and development of their root system can be recommended—such are: 1st. A ligature made with a piece of wire towards the middle of the underground part of the layer; 2nd. A split kept open with a small wooden wedge; 3rd. A tongue separated with a part of the wood, or simply barking. The principle of these operations consists in inducing the formation of *callus* favorable to the development of roots.

Watering and mulching to prevent the soil from drying also greatly helps the development of young plants.

3RD.—BEST TIME FOR LAYERING.

The most favorable time for layering lignified canes is immediately after the fall of the leaves. The cane buried at that time is submitted to a kind of stratification, and throws roots quickly and freely when the vegetation starts again. However, an exception must be made in the case of soils remaining too damp in winter, in which the buds may rot.

When herbaceous shoots are used they should be buried as soon as they are not too brittle, and can be bent without breaking. The more tender and greener a shoot is the more easily it throws roots.

To sum up, from the above descriptions we see that layering is generally a more complicated and more expensive method than propagation by cuttings, and this accounts for it not being generally used. However, it can render real services, as it insures a strike of every bud, even with varieties which do not root at all from cuttings.

HORTICULTURAL BRANCH.

BRIEF STUDIES IN THE ORCHARD AND GARDEN.

C. Bogue Luffmann.

CONTENTS FOR MAY.

I. Victorian Soil: The Influences Affecting it—for and against Plant Growth.

II. Fruits for various Divisions of the State.

III. Garden Plants, hedges, and shelter Trees for different soils, climates, and positions in Victoria.

IV. The Orchard.

V. Table and Drying Grapes.

VI. The Vegetable Garden.

VII. The Hardy Flower Garden.

Victorian Soil and the Influences Affecting it—For and Against Plant Growth.

The basic nature of soil is the primary cause of plant variation, in that it holds different kinds and proportions of foodstuffs, and has varying powers of attracting heat and moisture.

The composition and character of surface soil varies greatly as we travel from north to south in this State. The hot northern regions are deficient in those rock formations which go to the making of good soil. Moreover, the soil is coarser—much more gritty—and less composite in the north than we find it in the south.

The action of long, dry summers, absence of permanent vegetable covering, and the wasting influence of strong winds, are responsible for the monotonous and sandy nature of much surface soil.

The ordinary forces acting more or less regularly against local soil formation are heat, wind, and drought.

Normally, the wasting period of each year is as two to one against the gathering, the gathering period of the year averaging no more than four months, as against eight in which destructive and robbing agents are at work.

Every one engaged on the land should possess the capacity to look around and discern what agents first made the soil, and are still operating, for and against it.

The active agents in soil are—free mineral acids and salts, which are dissolved from rocks of different kinds; humus—the refuse of former vegetable and animal life; complete organic matter, both vegetable and animal, which is classed as manure; insects; coarse ferment germs; and bacterial life—and these are rendered capable of movement and change by the aid of heat, air, moisture, and light.

For highly organized vegetation, the best soil must ever be the most complete mixture. Monotonous soils can yield little of value.

Soil, to be useful, must be alive. Heat, water, air, and light quicken all its slumbering forces, and cause a kind of agitation, change, and pulsation similar to that which occurs in any animal body.

The root system of a plant always requires much cooler surroundings than its head; hence deep, cool soil is the great desiderata in all the low, open country north of the Dividing Range; and even in the south, and comparatively cool districts, every effort should be made to deepen and aerate the soil.

No fair balance is preserved locally between waste and repair. Crops soon eat out the foodstuffs when soil is warm and moist, hence many are misled into the belief that it is extremely rich, whereas its store is readily available, and usually soonest exhausted.

A very large proportion of Victorian soil becomes sour in winter—the extreme contrast between the winter and summer conditions inducing sourness wherever air and sunlight are excluded, or but poorly supplied.

*The scarcer the air in soil the more impure and profitless the food*stuff and the plant growth made. The fouling elements in soil do their work when water is superabundant, the temperature low, and air and light scarce quantities. The higher and better forms which prepare wholesome and sufficient food for the roots work only when the soil is moist, warm, varied in character, well exposed to sunlight, and capable of admitting air to a depth of several inches, or even feet.

The everlasting want in our orchard soils is more humus and lime. No cultivating or irrigating can supply either of these. Humus is not in itself a food, but a kind of home for the bacteria which work on and make the useful chemical changes in the soil. The bacteria have no power to act directly on inorganic masses, such as pure sand, rocky, gritty, slatey, or quartz-like matter. But in the residue of former lives, that is, in the indestructible refuse of decayed vegetable and animal matter—known as humus—they find a means to work and produce such acids as dissolve parts of the rock material of the soil, and thus bring about the desired elements for the food of roots.

Humus is generally scarce in hot climates. It is always scarce *where the climate is hot and dry. It is not used up by plants, but is* regularly wasted by the action of water, heat, and wind.

It cannot be too abundant in hot, dry country, but in wet, cold places, humus increases the water-holding power of the soil, hence it lowers the temperature, sours the soil, and stifles and rots the roots within it. Lime is not a direct plant food, but this may be said of all the food elements, they act on each other, part, and recombine, before the plant can make good use of them.

Lime cleanses soil by stifling and stopping the development of impurities—or what may be termed sour fermentation. It causes certain minerals to dissolve more readily and yield elements which they could not liberate of themselves. Lime is indispensable to all orchard land as a means to keep the soil sweet and wholesome, and also to insure strong and complete wood, which is alone able to provide good quality fruit. Trees are always weakly, prone to disease, attacks of insects, and shortlived, where lime is scarce or wholly deficient. One ton to thirty hundredweight should be supplied about every fourth year, as a means to keep trees strong, clean, and capable of yielding sound fruit.

Fruits for various Divisions of the State.

The following list of fruits is submitted with the object of aiding to a proper selection of species and varieties to accord with the demands of soil and climate.

The pear and the grape vine are the hardiest of all fruit producing plants grown in Victoria. They are capable of yielding a profit from the most southern sea-board to the most northern Murray. They also bear well up to 2,000 feet elevation, providing the variety is well chosen, and the soil and position equally well selected.

Most other tree-fruits have a smaller range, and far less capacity for withstanding heat and drought, hence it becomes necessary to choose with great care. The rough-barked apples, with thick, short-stalked, woolly leaves have most endurance in a hot and dry position. Upright growers of any species have greater vigour than the spreading and dependent of habit. A careful examination of the following sorts will reveal that they have been chosen with special regard to the type of tree most desirable in the northern and southern areas:—

Six Pears Suitable for Local Markets.

Williams' Bon Chretien.
Beurre de Capiamont.
Louise Bonne of Jersey.
St. Michael Archangel.
Doyenne de Comice.
Easter Beurre.

Six Pears Suitable for Export.

Beurre Clairgeau.
Vicar of Winkfield.
Eyewood.
Josephine de Malines.
Winter Nelis.
L'Inconnue.

Six Pears of Upright Growth, Suitable for Hot and Shallow Soils.

Beurre de Capiamont.
Beurre Clairgeau.
L'Inconnue.
Doyenne de Comice.
Keiffers' Hybrid.
Rutter.

Six Apples with Large Thick Leaves, most Suitable for Hard Positions.

Munroe's Favourite.
Annie Elizabeth.
Cleopatra.
Reinette de Canada.
Prince Bismarck.
Rymer.

Six Good Apples for North of Dividing Range.

Cleopatra.
Reinette de Canada.
Rymer.
Munroe's Favourite.
Prince Bismarck.
Annie Elizabeth.

Six Good Apples for South of Dividing Range.

Jonathan.
Rome Beauty.
London Pippin.
Esopus Spitzenberg.
Stone Pippin.
Shepherd's Perfection.

Six Cherries of Robust Growth.

Early Purple Guigne.
Bigarreau Rockport.
Bigarreau de Holland.
Black Tartarian.
Florence.
May Duke.

SIX FIGS.

*White Genoa.
Brunswick.
Brown Turkey.
*Grosse Verte, or White Adriatic.
Pallane.
Grosse Monstreuse de Lipari.

* Good for drying and preserving.

SIX PLUMS OF ROBUST GROWTH, SUITABLE FOR WARM, DRY LOCALITIES.

Prince Englebert.
Yellow Magnum Bonum.
Pond's Seedling.
Diamond.
Washington.
Belle de Septembre.

SIX GOOD GRAPES FOR NORTH OF DIVIDING RANGE.

Raisin des Dames.
Red Prince.
Waltham Cross.
Centennial.
Black Prince.
Muscat of Alexandria or Gordo Blanco.

SIX GOOD GRAPES FOR SOUTH OF DIVIDING RANGE.

Black Hamburg.
Blue Imperial.
Golden Chasselas.
Wilmot's Sweetwater.
Syrian.
Muscat Hamburg.

Garden Plants, Hedges, and Shelter Trees and Shrubs for Different Soils, Climates, and Positions in Victoria.

SHRUBS FOR DRY DISTRICTS.

Berberis communis.
Calycanthus floridus (allspice).
Erythrina (coral tree).
Lantanas of sorts.
Poinciana Gilliesii.
Boronia.
Chorozema.
Clianthus puniceus (glory pea).
Cuphea jorullensis.
Cuphea platycentra.
Diosma alba.
Euphorbia splendens.
Garrya elliptica.
Grevillea dimorpha.
Hypericum Moserianum.
Rosemary.
Guavas.
Statice Dicksoni.
Statice macrophylla.
Veronica parvifolia.
Veronica imperialis.
Veronica speciosa.
Calistemon rigidus (bottle brush).

TREES AND LARGE SHRUBS, SUITABLE FOR PLANTING IN HOT AND DRY DISTRICTS.

Oleanders.
Carob bean.
Yuccas.
Melia azederach.
Gleditschia.
Acacias.
Prunus pisardi.
Pomegranate.
Rose acacia (Robinia).
Tamarix gallica (flowering cypress).
Kaffir apple.
Dracœnas of sorts.
Ligustrum, or privet.
Macadamia ternifolia.
Photinia serrulata.
Schinus molle (pepper tree).
Stenocarpus Cunninghami.
Grevillea robusta.
Eucalyptus corynocalyx (sugar gum).
Eucalyptus globulus (blue gum).
Eucalyptus cornuta.
Ficus macrophylla (Moreton Bay fig).
Platanus orientalis (best of all trees for street planting in poor and warm soils).

HERBACEOUS PLANTS FOR DRY DISTRICTS.

Acanthus mollis.
Agapanthus (blue and white).
Aster (*Michaelmas daisy*).
Dieties bicolor.
Gazania splendens.
Herbaceous sunflowers.
Tawny-flowered day lily.
Leptosyne maritima.
Vincas.
Iris of sorts.
Tradescanta.
Chrysanthemums.
Dahlias.
Tigridias.
Anemone japonica.
Columbine.
Campanula.
Penstemons.
Salvias.
Tritoma (queen's lily).

List of Biennials and Perennials for Dry Districts.

Abronia arenaria.
Antirrhinum, or snapdragon.
Cannas of sorts.
Delphiniums.
Clianthus Dampieri.
Statice Fortuneii.
Gaillardia.
Mallows.
Petunia.
Verbenas.
Alyssum saxtile.
Violets.
Marguerites.
Castor oil plant.

Climbing Plants for Northern Districts.

Passiflora edulis.
Grape vines of sorts.
Bougainvillea spectabilis.
Bougainvillea glabra.
Canavallia Bonariensis.
Kennedeya rubicunda.
Tecomas of sorts.
Tropæolum tricolorum.
Tropæolum pentaphyllum.
Ampelopsis (Virginian creeper).
Bignonia capensis.
Clematis of sorts.
Cobea scandens.
Eccremocarpus scaber.
Ipomoea Learii.
Jasminum grandiflorum.
Jasminum capensis.
Jasminum subulatum.
Honeysuckle of sorts.
Mandevillea suaveolens.
Lophospermum scandens.
Phaseolus caracalla (snail flower).
Tacsonias of sorts.
Wisteria sinensis.

List of Annuals for Dry Districts.

Abronia umbellata.
Flos Adonis.
Amaranthus tricolor.
Amaranthus salicifolius.
Calindrina, of sorts mixed.
Candytuft, of sorts mixed.
Cosmos, of sorts mixed.
Cornflower, of sorts mixed.
Dianthus, of sorts mixed.
Acrolinum (red and white).
Ammobium grandiflorum.
Globe, Amaranth.
Godetia, of sorts mixed.
Sunflower, of sorts.
Lupins.
Nasturtium (dwarf and climbing).
Phlox Drummondi.
Poppies.
Portulacca.
Scabiosa.
Sweet Sultan.
Calliopsis.
Maize.

Succulents and Rock Plants. (Most of these will thrive without any watering or manuring of the soil.)

Aloes.
Agaves.
Cereus flagelliformis.
Cereus speciosissimus.
Crassula coccinnea.
Crassula Macrophylla.
Crassula tetragona.
Echeveria secunda.
Echeveria metallica.
Echeveria retusa.
Echeveria grandiflora.
Epiphyllum speciosum.
Epiphyllum plicatum.
Epiphyllum truncatum.
Melocactus Communis.
Mesembryanthemums, of sorts.
Opuntia, of sorts.
Phyllocactus, of sorts.
Rochea falcata.
Sedums, of sorts.
Sempervivums, of sorts.
Stapelia, variegata.
Cacti, in great variety.

Orchard Shelters for Hot Districts.

Almonds.
Figs.
Loquats.
Cherry plums.
Olives.
Acacias.
Melia.
Quinces.
Osage orange.
Cupressus torulosa.
Tamarix gallica.

Hedge Plants for Orchards and Gardens.

Osage orange.
Box thorn (African).
Privet.
Cupressus Lambertiana.
Cupressus torulosa.
Cherry plum.
Quinces.
Prickly acacia.
Loquats.
Olives.
Tamarix gallica (flowering cyprus)
Pomegranate.
Kaffir apple.
Almonds.

FRUITING PLANTS FOR INTRODUCING INTO GARDEN SCHEMES.

Acmenus.
Arbutus (Irish strawberry tree).
Natal plum (Arduina).
Berberis aquifolia.
Berberis communis (barberry).
Large red fruiting hawthorn.
Large yellow fruiting hawthorn.
Black fruiting hawthorn.
Queensland nut.
Prunus pisardi.
Guavas.
Pomegranate.
Persimons.
Elderberry.
Solanums, of sorts.
Egg plants.
Capsicums and chillies.
Eugenias.
Wineberry.
Himalayan bramble.
Passion fruit.
Variegated lemon.
Cape gooseberry.
Grape vines.
Oranges, loquats, almonds, cumquats.

PLANTS AND SHRUBS WHICH THRIVE UNDER TREES AND IN DEEP SHADE.

Hydrangeas.
Tradescantia.
Vinca.
Ferns, of sorts.
Lycopods, of sorts.
Wild strawberry (Fragaria).
Klenia.
Ivies.
Mesembryanthemums, of sorts.
Variegated mint.
Hypericums
Ivy geraniums.
Genestas.
Iris of sorts.
Double flowering raspberry.
New Zealand flax.
Double flowering kerria.
Anchor plant (colletia).
Buddleas.
Aucubas.
Bamboos.
Clematis, of sorts.
Creeping fig.
Lily of the valley.
Lily of the Nile.
Solomon's seal.
Agapanthus.

The Orchard.

A great variety of work calls for attention during this month.

Early planting is usually best in the far north, or wherever the soil is poor, and dry during winter. At the same time, it is impossible to contend that autumn, winter, or spring planting is desirable for a particular species, as so much depends on geographical position, the character and condition of the soil, and the hardihood of the tree. No young trees should be roughly handled or allowed to get dry at the roots. Most young trees are planted far too deeply, and this is brought about by faults in two forms ; one, the failure to set out the ground in bold elevated ridges before marking off the sites for the trees, and the other, planting the roots too deeply in the soil. Useful sorts of fruit trees for present day planting are given elsewhere in this issue. Be careful to order with due regard to the nature and depth of your soil, position as regards climate, and market requirements. Keep to a few sorts if you desire to live by the orchard. The peach is about the only fruit of which one requires many varieties to furnish a supply throughout the season. The most successful growers have upwards of 30. This admits of two or three kinds coming in weekly over ten or fifteen weeks. The number of varieties should be governed by the market one wishes to supply and the facilities which exist for obtaining pickers and packers. Usually there is great risk and as often considerable waste where a heavy parcel of soft fruit ripens at one time.

Of apples, pears, and apricots, three to six sorts should be the outside number, unless the orchard is of considerable size and market requirements extremely varied. Plums may run to nine or twelve

sorts, but if wanted for prune-making or factory use three or four sorts will be ample. Make sure that the thing you desire will thrive with you, that it will sell, and then grow it as largely as strength and means allow.

In no case should trees be pruned till the leaves become useless. Peaches may soon be taken in hand. Plums are quite ready. On large areas it is inadvisable to more than branch prune this fruit—that is, space out the most useful wood by removing all crowding and exhausted material, and then go carefully over each limb and thin its side growth. The extremities of each branch will also need reducing to a single shoot, in order that the drawing power of the topmost wood may be weakened and the sap kept down in the body of the tree, where it will go to the making of fruiting wood for future years. The foregoing applies only to fully grown trees. For instructions in building up young trees, see the special article on pruning competitions in last month's issue.

Citrus trees run great danger where their roots experience cold and wet at this season. Their leaves are a true indication of their condition, dark green, thick, and rather rough surfaces being the best signs of health. Neither cold, raw winds, nor frosty air should reach the main wood. Make sure that the drainage is perfect, and continue to pile up manure against next summer. Don't plant citrus where there is no means of watering them unless a deep soil and permanently moist, yet wholesome, substratum prevails. Don't plant plums, cherries, or apples in the thin, close, and poor dry soils of the north. We experience enormous losses annually by persistently planting trees where they are by nature debarred from rendering any profit.

Remove codlin bandages and at the same time scrape off any rough and dead bark, or, better still, coat the trunks with ordinary Bordeaux mixture thickened with clay or cow-dung to the consistency of thick paint. This has a decidedly cleansing effect, and it also strengthens the tree greatly by softening the bark and thus allowing for a more rapid and abundant circulation of the sap.

Be sure to thoroughly clean, deepen, loosen, and drain hard ground before planting trees. The common habit of ploughing strips or mere handkerchief plots and allowing the remainder to stand rough and hard can never be sufficient under local conditions. Recognise the value of fire. A great deal of filth can be removed only by this means. Grasses and rough, soft vegetation may with advantage be ploughed in, but all scrubby growth, bark, chips, wood, and leaves should be burnt, and the ashes scattered evenly over the surface.

In established orchards improve away all defects in the surface form as far as possible. Be clean, be thorough, from the trees' point of view, that greater vitality and profit may result.

Table and Drying Grapes.

Damp fruit has no keeping quality, so whenever the raisin pack is in a moist and puffy condition, it should be put on the market as quickly as possible. Failing this, it should be placed on warm trays

and exposed to the sun on fine, clear days. Where a drying kiln exists, there will be no difficulty in getting rid of the excess of moisture, but the fruit must be taken out of the boxes and spread thinly, or it will suffer in colour and flavour.

More care will have to be taken in all future planting, as the vines will be on the resistant stocks. Deep, free soils are alone able to yield fine, fleshy grapes in the northern areas. As one travels south the soil may in reason be more shallow. Those who contemplate extensions to vineyards for table or drying grapes, or venturing on entirely new areas, must be able to estimate the possible root system, the nature of which determines the size and quality of the vine and its fruit.

All smooth surfaces should be ploughed as soon as it is possible to get between the vines. The majority of our vineland remains flat, close, and airless over an unreasonably long period of each year, with the result that root action is most irregular, and the fruit of all sizes, forms, and degrees of quality. Manure vines according to their needs. Unless the soil is perfectly even it will be seen that certain spots are much more in need than others. Feed in autumn where a strong root growth is desired, but if the soil is very wet drain this off before working in the manure, or a foul and injurious mass will surround and throw the roots out of action instead of helping them. Nothing like well rotted stable manure for strengthening up needy vines; if this is not obtainable, bone dust, kainit, or the ordinary trade superphosphate will stimulate growth.

The Vegetable Garden.

This is the most favorable month in which to thoroughly prepare garden soil for general purposes. Sufficient moisture, manure, and other material now combine to make the working and dressing of the soil more economical than at almost any other season. Moreover, autumn or early winter-worked soil lying in the condition of fallow during the cold weather, undergoes many chemical and mechanical changes, and is therefore rendered fit and ready for any class of vegetable.

Draining is a most important and wofully neglected operation in Victorian garden practice, and neglect in this matter makes a terribly large proportion of cultivated soil unproductive over many months in the year. Surface drainage alone is rarely sufficient. Where water sinks in, and dries out in an irregular way, the cultivation ' as no control over the soil or crop. Water is the great carrying agent and provider of air and food. It must move laterally, not up and down, in the soil. It must never be stationary or permanent in, or on the surface of garden soil, hence the need and value of drains. They carry off excessive water only. They act against both heat and cold—drained land being warmer in winter and cooler in summer than undrained, hence always favouring the needs of roots. No land may be regarded as good, safe, and attractive to plants at all seasons unless it is intelligently drained.

The drawing power of drains varies according to the character of the soil, the depth at which they are placed, their size and method of construction, the surface contour of the ground, the rainfall, the plan on which they are laid, and the nature of the outfall. This last is very important, and yet frequently ignored by those who make a large outlay in draining. Flat land, if of no great extent, may be drained, but it is usually advisable to throw up soil in such positions, into high and narrow "lands" and insert short cross drains for the benefit of winter crops.

Drains cannot act their part to the full unless air circulates freely in them, and wherever there are many connexions and angles to a single scheme great care must be taken to preserve a draught which will insure a proper draining of all the soil.

The Hardy Flower Garden.

Many are the failures in seed sowing and attempts at plant raising in the open air, owing to a bad choice of season and preparation of the ground.

Such garden plants as are raised from seed are at best but adjuncts to, and cannot of themselves provide all that is desirable in a garden. Nevertheless, much bright colour, sweetness, and quiet charm is produced by the various annuals, biennials, and occasional plants which are raised from seed.

A long list of names in ones head will not help to a fine display. It is not names, but natures, that one must know. The ordinary length of life, time employed in germination, the degree of heat or cold favouring the most perfect development, the sunlight, shade, and air, stiff, free, rich or poor soil, all these and some others are factors which determine the appropriate season and method of sowing.

If soil grows extremely weedy or sour during winter, then autumn sowing is inadvisable for small plants sensitive to cold. If, on the other hand, the climate is dry, the soil thin and poor, and the summer very long, spring sown annuals are not likely to make strong, durable, and attractive plants.

Our annuals and other softwooded garden plants have been gathered together from almost every clime and degree of altitude beneath the line of perpetual snow, and if one would make a wise choice and select the season of sowing appropriate to the nature and wants of each, the place of origin and native habit must be considered. Owing to the changes to which plants are subjected, the winter flowering of one region become the summer flowering of another, and we have it in our power to frequently arrange for spring and autumn flowers from the same species, where in its native home this would rarely if ever occur.

A given combination of heat, moisture, and air favours the germination of seed. This may be regarded as a trite fact, but few indeed can really know it; otherwise, there would not be so much faulty sowing.

In local practice the bulk of our useful annuals, biennials, herbaceous plants, shrubs, and trees are sown in autumn and early winter, in order that they may develop into well rooted and sturdy subjects

before the approach of hot weather, when, in the case of their being required for immediate flowering, they will give abundantly, or, if shrubs or trees, they will be in the best position to meet the rigours of the summer sun, and a limited degree of dryness at the roots.

The best type of root growth—that which goes to the making of a sturdy plant, as apart from flower, is usually made in a falling temperature, hence the autumn—March, April, or May, according to the division of the State—is usually the best month to sow seeds of hardy plants. Those which will not endure frost, much wet, and cold soil, or are desired for autumn or early winter flowering, are planted in spring or early summer.

Narrow well raised borders having warm aspects, and if possible stone margins, attract sufficient heat, provide good drainage, and the best conditions for the free germination and development of autumn and winter sown seed. Rank soil should never be selected, no matter how hardy the seed may be, for where the plant starts in coarse material, correspondingly coarse and unprofitable growth is made. A very large percentage of the non-flowering plants or imperfectly formed flowers are due to imperfect feeding when young. Sweet fibrous loam, with manure rotted to a mellow mould, together with a good proportion of clean rough sand, makes the best of all seed-beds for the average plant. Where the soil is liable to become soddened with water, or cake into a firm crust, seed should not be sown. All seed-beds for autumn and winter use must be well raised; they are then much warmer, dryer, sweeter, and better ventilated than the surrounding soil.

Cover seeds according to their size and the nature of the soil. A mere film is sufficient where the soil is of a close nature. In weedy or sour positions the beds should be prepared weeks before they are wanted, that all weeds may be eradicated from the surface, and impurities improved away ere the seed is sown.

DESCRIPTION OF ILLUSTRATIONS OF TOBACCO PLANTS GROWN AT THE GOVERNMENT EXPERIMENTAL FARM, EDI.

By J. A. Temple Smith.

No. 1.—Tobacco shed on Mr. T. Smith's farm, King River.

No. 2.—View of crop of six acres on same farm of Hester, Conqueror, and Kentucky White Stem, nearly ready for cutting.

No. 3.—Loading tobacco in the field.

No. 4.—Tobacco on the scaffold in the field, undergoing the yellowing process before placing in the shed to be dried out.

No. 5.—Plant of the Hester variety, grown in Carolina for plug, and highly thought of. Grows well in Victoria.

No. 6.—Havanna seed. Cigar variety ; would suit well-drained, chocolate soils.

No. 7.—Sumatra. Some fine plants have been grown at the Government Farm ; would do well in well-chosen soils in the North-Eastern district.

No. 8.—Hester, plug variety, and Comstock Spanish.

No. 9.—Hyco, plug variety. Does not stand drought well, dries a bright yellow colour.

No. 10.—Comstock Spanish, cigar. Grows well and stands drought, matures early.

No. 11.—Conqueror, plug. One of the best varieties suited to local conditions, matures early, is hardy, easy to work, dries good colour.

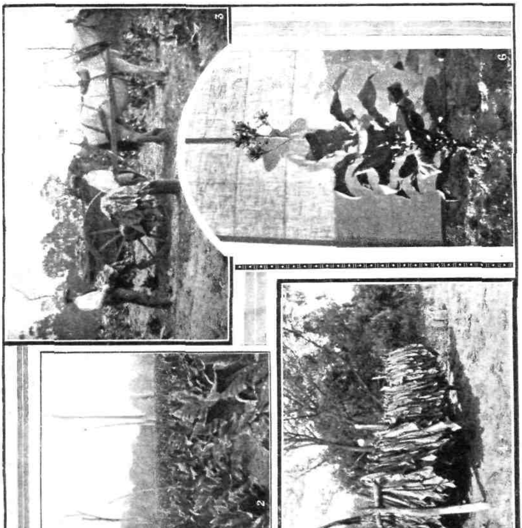
No. 12.—Giant Orinoco. Large, heavy leaf, but of coarse texture, not suited to our trade.

Several other varieties, viz., Connecticut seed leaf, Granville yellow, Col. Broad leaf, &c., have grown fairly well at the Government Farm, the Connecticut seed leaf being very successful. The crop has now been harvested, and though light, owing to the continued drought, should be of good quality. It has been clearly demonstrated at the Farm that some of the best American varieties can be successfully grown in this district, and as many growers intend planting with pure American seed in the coming season, a marked improvement should be noticed in the 1902–3 crop, both in quality and uniformity.

The Tobacco Industry.

Directions for Harvesting Tobacco Crop.

Tobacco plants are usually 22 weeks in maturing from the time of transplanting; and from four to six weeks after topping, when ready for cutting, the leaves become thick and brittle, and will crack when doubled between the finger and thumb. They also exhibit mottled yellow spots. It is always wise to allow the plant to ripen thoroughly, as the quality is much improved by so doing and the weight much greater ; the colour also is better and more uniform. The process of cutting is performed by splitting the stalk with a tobacco-knife down the centre to within 8 or 10 inches from the bottom, without cutting off the leaves. The stalk is then severed close to the ground. The plant is better left with the butt up in the sun for an hour or two, according to the heat of the sun, when it becomes toughened or wilted, and can be handled without fear of



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breaking or bruising. Tobacco should never be cut directly after rain, or when it is wet from any other cause. After heavy rain it is wise to allow at least one fine day to intervene before harvesting, to allow the nicotine to again accumulate. After tobacco has been well wilted, it can be placed in piles of five to ten plants, one directly above the other, until the cart is ready to take it to the scaffold or shed. In good fair weather the better plan is to hang the plants on the scaffold, first putting them on small sticks about four feet in length by opening the split stalk and hanging the plant across them. It is a mistake to put the plants too closely on the stick, the best guide as to distance being to allow the breadth of the hand between the butts at the top of the stick. The stick, containing eight to fourteen plants according to size, is then hung on the scaffold, allowing about ten inches of space to separate them. When the tobacco begins to colour a nice yellow or light brown, which usually occurs in this climate in seventeen or eighteen days, it should be removed to the shed. If the tobacco is to be cured by open fires, close your shed up as soon as all the leaf begins to colour well, and keep your fires going in pits in the floor, keeping a low degree of heat, say, 70 to 80 degrees, after which raise the heat slowly until at the end of two days you have reached 125 degrees, after which you can safely go to 125 degrees. The tobacco must be carefully watched until the mid-rib of the leaf is dry two-thirds of the way down, then the fires can be withdrawn and the shed will cool. The tobacco will then absorb a certain amount of moisture and become soft, and the colour will become regular. If wet weather should come after this process is finished keep small fires in the shed to maintain an even temperature. More tobacco is spoilt by too fast airing than too slow, and care should be taken to see that the tobacco does not get wet or poleburn while the drying process is going on. If such should occur, open up the shed at once to allow free circulation of air, and when the sweating stops go on with the fires.

The system generally followed by growers in Victoria is that of air curing in open sheds with the aid of little firing. The shed is covered round with hessian, which is rolled up during fine weather, and the air allowed to get freely through the tobacco. Directly wet weather ensues the hessian is dropped, the shed closed as close as possible, and small fires lighted in pits to keep out an excess of moisture.

In the next issue directions will be given for bulking down, fermenting, and grading.

ENTOMOLOGICAL AND ORNITHOLOGICAL BRANCH.

MASKED WOOD SWALLOW.

(*Artamus personatus*, Gould.)

By C. French.

The male of this species has, according to Gould, the face, ear-coverts, and throat jet black, bounded with a narrow line of white; crown of the head sooty black, gradually passing into the deep grey which covers the whole of the upper surface, wings, and tail, the latter tipped with white; all the under surface very delicate grey; thighs dark grey; irides blackish brown; bill bluish at the base, becoming black at the tip; legs and feet bluish grey. The female differs principally in having the colouring of the bill and the black mark on the face much paler.

The plate of this fine bird will at once explain the differences in point of shape and colour between this and the other species, which we intend dealing with in the *Journal*.

The Wood Swallows, "Summer birds of the early colonists," are amongst the very best of our insect-eating birds, being almost strictly insectivorous, and seldom eating fruit or seeds of any kind.

This is a lovely species, probably the handsomest of all; the female building her nest mostly in low trees or bushes, where, unfortunately, the small boy and the indiscriminate egg-hunter has no difficulty whatever in finding them. According to our best authorities, the number of eggs laid by the female of this species varies somewhat, but in all the nests which I have peeped into there were but two. Mr. Hall mentions having taken three in a clutch, whilst Gould mentions two or three as the number.

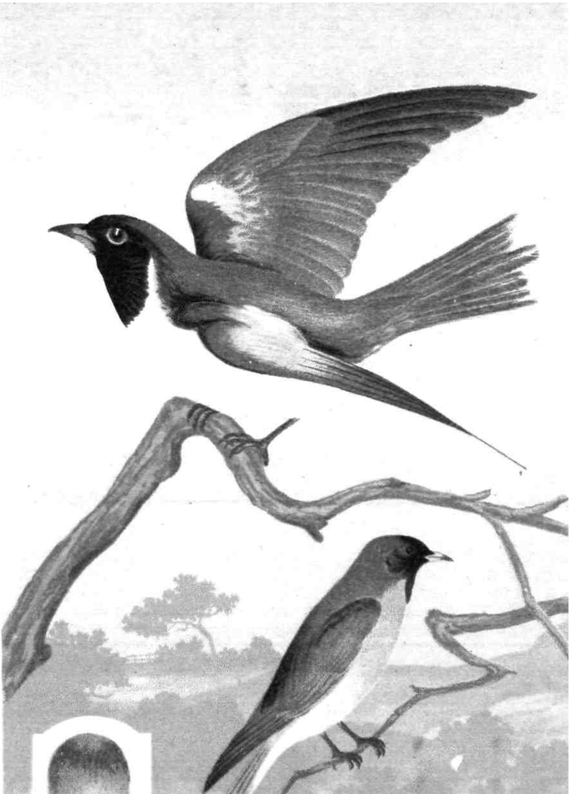
The nests of the Wood Swallows are frail, and somewhat carelessly built of small twigs and fibre, and in the case of the "Masked" half-dried grass is often used as a lining.

This bird is more commonly found in the warmer parts of the Murray districts, but they occasionally come down to places near to Melbourne, and a few years ago were to be found in the Nar-nar-goon district in thousands, the nests being here, there, and everywhere, the Bell birds on that occasion being unusually numerous.

The Masked Wood Swallow has a wide range, having been found in Queensland, New South Wales, interior, South Australia, West and South-west Australia.

The whole of the genus *Artamus* should be carefully protected as being one of the growers' best friends, and being, as I mentioned previously, strictly insectivorous, there can be no possible excuse for killing them.

In Mr. Campbell's new work may be found a very beautiful photo. of the nest and eggs of this valuable bird.



MASKED WOOD-SWALLOW.

(*Artamus personatus*—Gould.)

HOODED ROBIN.

(*Melanodryas bicolor*—Vig. Horsf.)

HOODED ROBIN.

(*Melanodryas bicolor*, VIGORS and HORSFIELD.)

By C. French.

This is one of the finest and most useful of the Robins, now unfortunately much less plentiful than it was many years ago. The nest is cup-shaped, and constructed of strips of bark coated with bark, and, as Mr. Campbell states, with shields or pieces of outer bark stuck on with spider's web and lined inside with grass, hair, &c. The male has the head, throat, neck, back, rump, upper tail coverts, and the two centre tail feathers deep velvety black ; the next tail feather on each side black on the inner web, white on the outer web, and largely tipped with black ; wings dull black ; under surface of the shoulder, breast, abdomen, and under tail coverts white ; bill black ; feet blackish brown. Eggs, three, occasionally four.

Gould says that the young immediately after leaving the nest are dark brown, with a stripe of light-brown colour down the centres of each feather, the markings of the wings and tail resembling those of the adult.

This is the most active of the Robins, and in open and lightly timbered country, also in flats interspersed with here and there a large tree, these birds may be seen darting about in search for insects, principally Coleoptera (beetles) and ground insects, as grubs, &c., which it eats voraciously.

In a note, Mr. Campbell states that the female of the Hooded Robin does not solely undertake the task of incubation, proved by the fact of Mr. A. Campbell, jun., having observed a male bird leave a nest containing two fresh eggs at Spring Vale, Victoria, 23rd November, 1895. Breeding months, July to December, the nest being placed very near to the ground. Found also in Queensland, New South Wales, South Australia, West and South-west Australia, as quoted by Ramsay in North's work on the "Nests and Eggs of Australian Birds."

The Hooded or Pied Robin is a bird which cannot easily be mistaken for any other bird, and it should be carefully protected for the grower.

ANIMAL PARASITES.

By A. A. Brown, M.B., B.S.

No. 4.

Tapeworms.

After dealing with their development in previous numbers we now begin the discussion on tapeworms that are of particular interest to producers, and we shall endeavour to point out in a general sort of way how the danger of invasion of animals by these parasites may, in some measure, be frustrated, if the preventive measures briefly recounted are resolutely adopted. A hydatid, or head from a hydatid cyst, introduced into the stomach of an animal in which nature has intended it to pass its mature existence as surely becomes a tapeworm as a grain of wheat planted in the soil develops in due season into the wheat-plant.

Tapeworms in Sheep.

In lambs, this season, tapeworms have been rife, and their presence had much to do with the unthriftiness the animals presented. Other causes of the unthriftiness in lambs this season have to be sought for in the prolonged droughts. The grass everywhere was early parched up, and the waterholes early became dry. The shortage in the food and water supplies, along with the presence of worms in their intestines, caused the lambs to fall away very much in condition. Tapeworms *may cause animals to lose condition from the quantities of* partially elaborated material they are continually abstracting to promote their own welfare from the intestinal tracts of the lambs.

How Tapeworms Feed.

Tapeworms have no mouths and no digestive tracts. Their nourishment is obtained from the juices and nutrient material contained in the lambs' intestines by the process of endosmosis. They feed like plants. The nourishing juices, as in the spongioles of the roots of plants, simply enter everywhere through the skin to gain the cellular tissue, of which their bodies consist. Independently of these thefts of the nutrient material which should have gone to build up the tissues of the lambs, tapeworms may set up a condition of irritability in their bowels causing scouring, thereby leading to further wasting of their bodies. When animals are insufficiently fed tapeworms seem to have a pronounced effect in aggravating the symptoms that are produced by a deficient food supply.

Size and General Appearance of Sheep Tapeworm.

The tapeworm (Tænia Expansa) infesting the intestines of sheep may attain a length of from 15 to 20 feet, and several worms may be found in the intestines of a single host. As is the case in all tapeworms, *the Tænia Expansa is divided into a more or less greater*

number of segments or joints. Its embryo gains the sheep's intestines by means of the food and water it swallows. The head of the worm is small, and furnished with suckers, and the head end is the narrowest part of the body. There is no mouth, no intestinal tract, *no crown of hooks. The segments succeeding the head are very small,* but gradually enlarge as the posterior extremity is approached, where the greatest breadth is presented.

Segmental Development.—Oval Development.

The worms increase in size by the formation of new segments between the head and succeeding segment. If all the segments *detach themselves from the head, and the head remain behind attached* to the intestinal wall, it sets to work to form a new lot of joints. In treating animals suffering from tapeworms the head must be compelled to release its hold, and be expelled along with the remainder of the chain. Each segment possesses a complete set of reproductive organs—male and female. The number of eggs that a single segment is capable of producing is enormous. The segments, as they mature, detach themselves from the parent stem, and remain for a time free in the intestinal tract, but eventually escape with the droppings to the outside world, where, on the pastures, they seek moist situations. The wall of the segment then decays, and the eggs are scattered about. Each egg is enclosed in a shell covering, and it *undergoes no further development until certain things happen.* The shell covering may decay, and the egg be set free, or the egg may be swallowed by molluscs, caterpillars, slugs, &c., which may serve as intermediary hosts in the course of development. In the body of the intermediary host the egg may progress a certain stage onward in its development. There is no true cystic stage in the development of the tapeworm of the sheep. The body of the bladderworm, or cysticercoid, *is solid, or nearly so. After having progressed through the body of* the intermediary host, and, after having escaped from it, the embryo finds its way into the intestines of the sheep, and by means of the special apparatus by which it is endowed, it fastens on to the lining of the intestine to develop into an adult tapeworm.

Places where Tapeworms are Contracted.

Sheep roaming over marshy districts are prone to tapeworms, as it is on damp grounds that the embryos flourish. Sheep grazing over soils rich in common salt are particularly free of tapeworms. Tapeworms do not prevail in districts where salt-bush abounds. Salt-bush is rich in soda salts, and also possesses active anthelmintic, or worm-expelling properties. Tapeworms prevail in marshy localities, and are particularly rife in very wet seasons. Marshy lands are not suitable for sheep. There they not only contract tapeworms, but lungworm, stomachworm, fluke, hydatids, foot-rot, and anthrax. It may happen in the course of time from the utilization of marshy lands for other purposes than sheep breeding, or from a proper system of draining such lands, and of treating them with salt, that tapeworms, &c., may *become less common in our flocks.*

Remedial Measures.

If one wants to keep his flock free of tapeworms, then no sheep should be grazed over marshy country, as it is on such country that the embryos are picked up. If one risks grazing over such country, then preventives, to guard against infestation occurring, must be resorted to. As preventives, licks must be bountifully distributed over the pastures. Blocks of rock-salt should be placed here and there for the sheep to lick, or, better still, but somewhat more expensive, *licks composed of salt, sulphate of iron, sulphur and ginger, should* be employed. This lick is not only a preventive, but is actually a compound that will expel worms if resident in the intestines of lambs. The proportion of the ingredients should be as follows :—

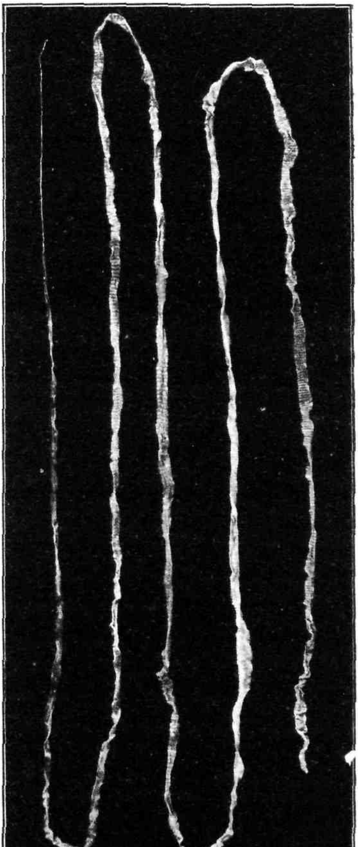
Common Salt	224 lbs.
Powdered Sulphate of Iron	14 „
Sulphur	4 „
Ground Ginger	2 „

The above should be thoroughly incorporated before being placed in feeding troughs on the pastures.

A lick of lime and salt is effective, and is made up by adding 6 lbs. of slaked lime to every 112 lbs. of salt. Except in winter the above *is improved by adding to it 8 lbs. of sulphur.*

Mixtures of salt, sulphate of iron, and slaked lime could also be employed with considerable advantage.

A combination of salt and sulphate of iron not only acts as an anthelmintic, but also acts as a stomachic, and stimulates digestion. These drugs, therefore, serve to keep the sheep in health, and, not only then improve the quality of the flesh, but tend to an increase in the quantity of fat and improvement in the constitution of the wool. It will be found after a trial that treating animals infested with worms will pay. The administration of drenches, however, to hundreds and hundreds of sheep, is practically impossible, and in the treatment of sheep infested with worms it has to be expected that the individuals of the flock will take their medicine voluntarily, and for this reason licks are recommended. Treatment by licks applies to flocks roaming over extensive tracts of country, but to valuable sheep remedies should be administered by hand. To valuable lambs suffering from tapeworms, linseed oil and oil of turpentine, after subjecting them to an initial fast, should be given in the form of a drench. After keeping them away from food for from 18 to 20 hours, but allowing access to water, 20 to 30 drops of oil of turpentine, along with 40 grains of powdered sulphate of iron, and half-an-ounce of salt, should be given in 2 ounces of linseed oil. Areca-nut, a proved specific in dogs, and male fern, the remedy par excellence in man, do not prove effectual remedies in sheep. If a large number of lambs is to be treated, then a commensurate quantity of the drugs in the proportions indicated should be mixed up. The services of two men would be required, one to throw and hold the lamb, and the other to pour the mixture down its throat, using a drenching horn for the purpose.



TAPEWORM OF SHEEP (*Taenia expansa*). 10 feet in length.
The transverse markings seen along the worm indicate its division into segments.

EXPERIMENTS IN THE TREATMENT OF "BLACK SPOT" OR "SCAB" OF APPLE AND PEAR DURING SEASON 1901-2.

By D. McAlpine.

Introductory.

In connexion with diseases caused by fungi, there is at least one point which has struck even the most casual observer, and that is that the diseases vary in their intensity according to the nature of the weather, and that some seasons encourage disease much more than others. Hence the idea has arisen, and is still firmly rooted in the minds of many growers, that the weather is the cause of the mischief, and that until you can control the weather there is no hope of overcoming the disease. But while the weather side of the question is the first and most easily observed, there is another side which has to be taken into account, and that is the dependence of the disease also on the presence of certain lowly forms of life, which prey upon and cause disease in those higher forms which it is the object of the grower to cultivate.

By many growers the presence of any active living agent as the cause is ignored, and it comes to this, that they are helpless and hopeless in dealing with such visitations, because they are considered to be the result of causes over which they have no control, and that, therefore, any action they may take further than strengthening the tree to resist the unfavorable climatic conditions, will be of no avail. Now the "Black Spot" or "Scab" of the apple and pear is a typical case of a disease believed by many to be wholly due to the weather conditions, and not amenable to any direct treatment. It may, therefore, be used as a fitting example for impressing upon growers the two leading facts which lie at the root of our preventive treatment.

1. That while the weather exercises a powerful influence on the development and spread of the disease, it is directly caused by a *fungus*, which lives and grows, and multiplies at the expense of its host.

2. That by destroying the *spores* (which are comparable to the seeds of the higher plants), or preventing their germination, there will be no development of that particular disease, although the weather favorable to it may be present.

Before, however, dealing with the nature and life-history of the fungus concerned in this disease, and going into details about spraying, I will first of all give instances of the successful treatment of the disease by various orchardists as well as at several experimental plots instituted by the Department of Agriculture, and then show how these results have been obtained. But it must not be concluded that spraying the orchard is all that is necessary to be a successful grower, in fact it is only one of the elements of success. It does not make up for the want of proper tillage, nor insufficient plant-food, neither does it render

pruning less necessary, but wherever the cause of loss and unfruitfulness is due to a fungus, as in this instance, then spraying at the right time, and in the right way, does prevent the loss, and makes the orchard fruitful.

Varieties Subject to the Disease.

Every orchardist has observed that some varieties are more subject to this disease than others, as well as that the liability to disease may vary according to climatic conditions.

Thus in the Doncaster district the following are the most liable varieties of apple:—Yates, Stone Pippin, Scarlet Nonpareil, Irish Peach, Pomme de Neige, and Munro's Favorite; while Rome Beauty and Jonathan are only slightly attacked. In the Somerville district, Sturmer Pippin, Newtown Pippin, Ben Davis, Shepherd's Perfection, and Cleopatra are the most liable, while Jonathan and Five Crown are comparatively free. In the Pakenham district the worst were, Newtown Pippin, American Golden Russet, Yates, Sturmer Pippin, and Scarlet Nonpareil; while Jonathan and Five Crown were less susceptible.

These were the three districts in which experiments were carried out in connexion with "Black Spot," and the Yates variety was chosen at Pakenham and Doncaster as being one of the most liable to the disease, and the Sturmer Pippin at Somerville, as it was the worst there.

It is necessary to choose varieties which are known to be liable to the disease when testing various preparations, since the results will be misleading, if the variety is clean, independent of any treatment; it has also to be clearly understood that the "Black Spot" is due to a fungus, and must not be confounded with "*Bitter Pit*," as is too frequently the case, since spraying so far has not been found to prevent the latter.

Results of Treatment in Mr. Hatfield's Orchard, Pakenham.

The fruit on the sprayed and unsprayed trees of the Department's Experimental Plots will not all be picked and weighed until the beginning of May, so that results can not yet be given, but several growers carried out experiments on their own account, and some of these results are now available.

At Mr. Hatfield's orchard I selected a sprayed and unsprayed tree of Stone Pippin and Scarlet Nonpareil respectively, growing alongside of each other, and had the fruit carefully sorted out and weighed. The spray used was a mixture of his own preparation, consisting of an addition to the ordinary Bordeaux Mixture. Only one spraying was given, just before the bursting of the individual flowers in the bud.

The trees of the Scarlet Nonpareil, in low lying reedy ground, as shown in Plates I. and II., were small, but of equal size and vigour, and there was no evident reason why both should not have borne about equally, under ordinary conditions. The sprayed tree, however, yielded 169 lbs. of marketable fruit, and of first quality, while the unsprayed tree only yielded 3½ lbs. of fruit altogether, and of that

only one apple was saleable, weighing $3\frac{1}{2}$ ozs. The 3 lbs. of unmarketable fruit on the sprayed tree, included weather-cracked and moth-eaten apples, and only about three were affected with "Black Spot." The fruit obtained from each tree is shown in Plates III. and IV. and conveys better than any figures an idea of the advantages to be obtained from spraying.

The two Stone Pippin trees were very unequal, the unsprayed tree being one of the largest and finest in the orchard, while the sprayed tree was only about half the size. Nevertheless, the results showed the great superiority of the sprayed tree. It yielded practically 100 per cent. of marketable fruit, and 83 per cent. of first quality, while the unsprayed tree yielded 78 per cent. of marketable fruit, and 11 per cent. of first quality. Only clean fruit was reckoned of first quality.

TABLE SHOWING YIELDS AND PERCENTAGE OF MARKETABLE FRUIT.

Variety of Apple.	Marketable Fruit in lbs.		Unmarketable Fruit in lbs.	Gross Yield lbs.	Per cent. Marketable.	Per cent. First Quality.
	First.	Second.				
Stone Pippin—						
Sprayed Tree ...	263	53	$\frac{1}{2}$	$316\frac{1}{2}$	100	83
Unsprayed Tree...	$14\frac{1}{2}$	87	28	$129\frac{1}{2}$	78	11
Scarlet Nonpareil—						
Sprayed Tree ...	169	—	3	172	98	98
Unsprayed Tree...	—	$3\frac{1}{2}$ oz.	$3\frac{1}{2}$		6	—

NOTE.—The solitary Apple reckoned marketable among the unsprayed Scarlet Nonpareil was only comparatively clean on one side, but on the other a considerable amount of scab.

Mr. Ingram's Orchard, Black Flat.

This orchardist first started spraying eight years ago, as the result of a lecture I delivered in the district on that subject; and the appearance of the apple and pear trees in his orchard, loaded with clean fruit, fully justifies his firm belief in the virtue of spraying for "Black Spot." A great number of trees, previous to my lecture, had been cut down on account of the "spot," and only one Stone Pippin was allowed to remain, but Mr. Ingram is now positive that he can grow any variety free from "spot" by means of spraying.

The apples Rymer, Jonathan, Five Crown, and Duchesse of Oldenberg, are always comparatively clean, but of pears he cannot name a single really resistant variety, Beurre Bosc being one of the most liable.

As the result of experience, Mr. Ingram sprays only once, just when the buds have burst; and in some cases where trees were sprayed a second time in November, when the apples were about the size of plums, there was no perceptible advantage.

The strength of Bordeaux Mixture used, is 8 lbs. bluestone and 8 lbs. lime to 50 gallons of water, (8-8-50), but the experience of this season will show that a much weaker mixture can be advantageously employed.

The pears sprayed only once just after the buds had burst were so clean, that it was difficult to find a single "spotted" fruit, and the Beurre Bosc, which he found to be the most liable and dirtiest of any, he now regards as the greatest triumph in favour of spraying.

There was one interesting pear tree there, sprayed when the bloom was fully out with a mixture of 6-6-50 instead of 8-8-50, and the abundance of spotless fruit showed that it was a success. This is another experience gained during the past season, and a mixture of 4-4-50 in the form of a fine spray, applied when the blossom is out, will be tried during the forthcoming season.

The wet spring was responsible for the great development of "Black Spot," and although the orchard is all tile-drained, the trees would have suffered severely but for the spraying. The opinion was also indorsed that spraying improves the keeping quality of the fruit.

PLATE I.

SPRAYED TREE.

PLATE II.

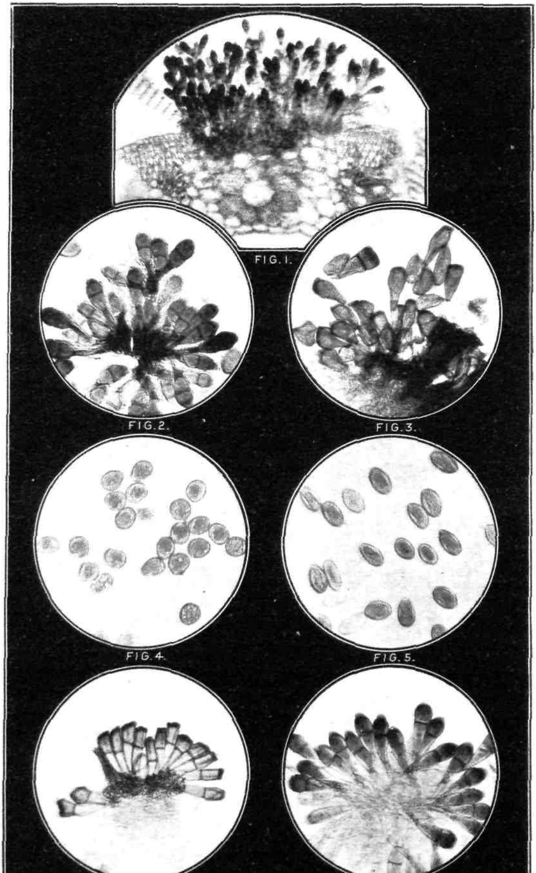
UNSPRAYED TREE.

PLATE III.

SPRAYED TREE—With Fruit at Base.

PLATE IV.

UNSPRAYED TREE With Fruit at Base.



G. H. Robinson, Photo-micro

WHEAT AND BARLEY RUSTS.

By D. McAlpine.

The two kinds of rust occurring on wheat and barley respectively in Australia are here represented, as seen under the microscope, and referred to in the last issue of this *Journal*. The spores or reproductive bodies are just as distinct as the grain of wheat itself, only they are too small to be seen individually by the naked eye, so they require to be magnified. It was not until the latter half of the eighteenth century that the true nature of rust was discovered, although as a blight it was well known to the ancients. Jethro Tull, writing in 1733, attributes it to the attacks of small insects "brought (some think) by the east wind," which feed upon the wheat, leaving their excreta as black spots upon the straw, "as is shown by the microscope." It is now known to be a fungus, and the "black or rusty spots" are just masses of spores, as shown in Figs. 1, 3, 6, and 7.

EXPLANATION OF PLATE.

Summer Rust of Barley (*Puccinia graminis*).

Fig. 1.—Section through sheath of barley with black rust, showing the two-celled teleutospores bursting through the cuticle (× 100).

Fig. 2.—One-celled uredospores and two-celled teleutospores (× 200).

Spring Rust of Barley (*Puccinia simplex*).

Fig. 3.—Black rust pustule from sheath showing the teleutospores, all except one being one-celled (× 200).

Spring Rust of Wheat (*Puccinia triticina*).

Fig. 4.—Group of red rust spores—Uredospores (× 200).

Fig. 6.—Group of black rust spores—Teleutospores (× 200).

Summer Rust of Wheat (*Puccinia graminis*).

Fig. 5.—Group of red rust spores—Uredospores (× 200).

Fig. 7.—Group of black rust spores—Teleutospores (× 200).

PARTICULARS of Frozen Produce exported from Victoria from 20th March, 1902, to 20th April, 1902.

Description of Produce.		Shipped through Government Cool Stores.	Shipped through other Cool Stores.	Total Quantity Shipped.
Butter (Victorian)	lbs.	207,032	...	368,232
,, ,, Tinned ...	,,	...	161,200	
,, (ex Bond)	,,	245,000	194,500	439,500
Milk and Cream (Concentrated) ...	cases	548	156	704
Cheese	lbs.	...	6,180	6,180
Eggs	dozen	12,550	...	12,550
Rabbits	pairs	178,678	618	179,296
Hares	,,	8	...	8
Poultry	head	8,931	945	9,876
Lambs	carcasses	519	3,914	4,433
Sundries	lbs.	4,714	263,040	267,754
Fruit	cases	2,373	5,377	7,750
Fruit Pulp	,,	1,258	...	1,258

R. CROWE,
Dairy Expert.

SUMMARY.

MONTHLY RETURN of Farm Products Exported and Certified to from 21st March to 21st April, 1902.

WAR OFFICE CONTRACTS.

SOUTH AFRICA.

No. of Bales.	Products.	Vessel.	Weight.			
			Tons	cwt.	qrs.	lbs.
54,879	Oaten Hay	*Wyneric*	2,467	16	2	14
64,421	,, ...	*Austriana*	2,932	7	2	0
119,300	... ...	.. ..	5,400	4	0	14

The above completes the Hay Contracts for the War Office up to date.

3,098 bales	Compressed fodder	Private shipment.
17,384 bags	Wheat	,,
1,160 cases	Potatoes	,,
2,326 ,, ...	Onions	,,

NEW SOUTH WALES.

1,512 bags	Oats, feed	Private shipment.
27 ,, ...	Barley, feed	,,
1,302 ,, ...	Potatoes	,,
2,568 ,, ...	Onions	,,

QUEENSLAND.

736 bags	Oats, feed	Private shipment.
96 bales	Straw, oaten	,,
1,121 bags	Potatoes	,,
561 ,, ...	Onions	,,

WEST AUSTRALIA.

218 bags	Potatoes	Private shipment.
258 ,, ...	Onions	,,

MANILA.

1,099 bags	Onions	Private shipment.

TASMANIA.

30 bags	Onions	Private shipment.

J. KNIGHT.

EXPORT OF FRUIT.

By C. French.

Return showing number of cases of Fruit, Plants, and Bulbs inspected for export to Australian States, and New Zealand only, for month ending 20th April, 1902 :—

Name of Fruit, &c.	Number of Cases Inspected.	Number of Certificates Given.
Apples	819	12
Bananas	2,029	266
Figs	40	1
Grapes	1,781	200
Lemons	147	54
Melons	5	5
Oranges	86	57
Passion Fruit	47	24
Peaches	815	66
Pears	2,845	69
Pine Apples	101	72
Plums	946	67
Quinces	2,996	67
Tomatoes	1	1
Mixed Fruit	1	1
Plants	288	15
Bulbs	8	8
Total	12,955	985

Return of Fruit Inspected for Export to England and ports beyond the Australian Commonwealth, for Month ending 19th April, 1902.—

England—	United States, America—	South Africa—
Apples ... 10,378 cases	Apples ... 100 cases	Apples ... 350 cases
Grapes ... 226 ,,		
Pears ... 131 ,,		
Peaches ... 5 ,,		

RAINFALL IN VICTORIA.

MONTH OF MARCH, 1902.

By P. Baracchi.

Areas.	Actual Average Rainfall recorded in each Area, in March, 1902.	Average Rainfall for each Area for the Month of March, based on all previous years of record.	Maximum Fall recorded within each Area during March, 1902.
	Inches.	Inches.	Inches.
A	1·05	0·86	1·56 at Kenmare
B	1·03	0·88	1·36 " Warracknabeal
C	1·14	1·33	1·80 " Colac
D	1·67	1·65	2·20 " Cape Patton
E	1·05	1·16	1·68 " Charlton
F	1·72	1·57	2·20 " Chiltern
F1	2·50	1·72	2·81 " Seymour
F2	2·10	2·64	2·40 " Beechworth
G	2·28	1·48	3·46 " Kyneton
H	3·72	1·93	5·30 " Kilmore
I	5·30	1·69	8·77 " Sunbury
I1	5·11	2·22	7·74 " Hastings
K	4·55	2·51	6·55 " Foster
L	4·93	2·07	7·06 " Bairnsdale
M ...	2·00	2·74	2·00 " Gabo

Subdivisional Areas of the State of Victoria, representing typical Distribution of Rainfall.

A. North-west—Mallee country, including the counties of Millewa, Taila, Weeah, and Karkarooc.

B. Central West—Including the counties of Lowan and Borung.

C. Western Districts—*Including the counties of Follett, Dundas, western half of Ripon and Hampden.*

D. South-western Districts and West Coast—Including the counties of Normanby, Villiers, Heytesbury, and Polwarth.

E. Northern Country.—Including the counties of Tatchera and Gunbower, and the northern half of Kara Kara, Gladstone, and Bendigo, and the north-west portions of Rodney and Moira.

F. Northern Country—Including the greater part of the county of Moira, the north-eastern quarter of the county of Rodney, and the extreme north-west of the county of Bogong.

F1. Central North—Including the county of Anglesey, the west and northern parts of the county of Delatite, the extreme south of the county of Moira, and the south-east quarter of Rodney.

F2. Upper Murray—*Districts from Wodonga to Towong.*

G. Central Districts North of Dividing Ranges—Including counties of Talbot and Dalhousie, southern half of the counties of Kara Kara, Gladstone, and Bendigo, and the south-west quarter of the county of Rodney.

H. Central Highlands and Ranges from Ararat to Kilmore.

I. South Central Districts on the west and north side of Port Phillip Bay—Including the counties of Grant, Grantville, and Bourke, and the eastern parts of the counties of Hampden and Ripon.

I.1 *South Central Districts east of Port Phillip Bay, &c.—Including the counties of* Mornington and Evelyn.

K. Regions of Heaviest Rainfall—including all the mountainous Eastern Districts, and South Gippsland.

L. South-eastern Districts — Gippsland, and counties on the New South Wales Border.

M. Extreme East Coast.

The following is the amount of Rainfall recorded over Victoria during the five days, 24th March 9 a.m., to 29th March 9 a.m, 1902.

(The capital letters indicate the subdivisional areas as usual.)

Subdivisional Area.	Average Recorded.	Maximum.
	Inches.	Inches.
A	0·93	1·38 at Rainbow
B	1·01	1·36 " Warracknabeal
C	1·11	1·75 " Colac
D	1·41	2·00 " Cape Patton
E	1·05	1·68 " Charlton
F	1·67	2·15 " Benalla
F[1]	2·50	2·81 " Seymour
F[2]	2·10	2·40 " Beechworth
G	2·22	3·38 " Bendigo
H	3·72	4·08 " Daylesford
I	5·30	8·63 " Sunbury
I[1]	4·98	7·62 " Hastings
K	4·19	5·50 " Wilson's Promontory
L	4·84	6·99 " Bairnsdale
M	1·60	1·60 " Gabo Island

The Heavy "March Rainfall," 24th March—29th March, 1902.

By P. Baracchi.

On Monday, 24th March, and Tuesday, 25th March, the weather chart at 9 a.m. indicated the setting in of westerly weather, namely, strong westerly and north-westerly winds with squalls and passing showers which, under usual conditions, were expected to affect only, or chiefly, *the southern districts of the State.*

But later on Tuesday the distribution of atmospheric pressure took a different character. The extended area of low pressure previously existing over the Southern Ocean deepened into a relatively small and definite area with centre to the south-west of the State, and with its axis laying in a nearly north and south direction, but tending to turn the opposite way to the hand of a watch, while the depressed area was moving, as a whole, towards the north-east.

On Wednesday, 26th March, this depression enveloped the whole of *the State, remaining almost stationary till the following day,* then advancing, very sluggishly, towards the north-east, until, by Saturday, its centre had advanced to the eastward of Sydney, by which time its influence had almost vanished, or affected only the extreme eastern districts of the State. The immediate causes of the unusally heavy rains which accompanied the above-described distribution of atmospheric pressure and its changes during the period in question were: the deepening of the depression, which increased its energy as it approached our coast; its motion towards the north-east, which *enabled it to invest the whole of the State;* and the sluggishness of its *progress which prolonged its influence over Victoria.* So that the

more important conditions favorable to the production of prolonged cyclonic rain were co-existent. If a depression of this character had occurred a few months later when the soil is usually saturated with moisture, the chances are that a great part of the State would have been very severely damaged by floods. During the past five or six months, areas of low atmospheric pressure passed near us, or over us, almost every week; but with a velocity of translation approximately *from west to east so abnormally great that their influence was only* felt by us for a few hours in each case, and generally resulted in a simple change of wind from north to south, leaving behind a prevalence of westerly and south-westerly winds with little or no rain, which accounts for the prevalent low temperatures of the last spring and summer.

This was then the first of a long chain of depressions which marks a distinct change of conditions in the previous cyclonic régime, and it is not unlikely that the new conditions may persist for some time to come.

The rain, as shown in amount and distribution in accompanying table, set in on Monday evening, 24th March, over the greater part of the State, excepting the extreme north-western and south-eastern districts. On the following Tuesday it became general, and, probably not a single acre of land was left dry.

It continued on the following Wednesday.

It cleared up over the Mallee and Wimmera, but light rain continued to fall over the lower western and south-western districts, and heavy rain fell over all other parts of the State, being heaviest over the central southern areas around Port Phillip and Westernport Bay, and in Gippsland.

On Friday it had cleared up generally over the western half of the State and country north of the Dividing Ranges, excepting some occasional showers at scattered places, but further heavy rain fell in various parts of eastern and south-eastern districts. Fine weather extended further east on Saturday, and only occasional light coastal mists followed for another day.

STUDIES ON WINE-STERILIZING MACHINES,

BY U. GAYON,

Professor of Physical Sciences in the University of Bordeaux.

(*Translated.*)

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NOTES ON THE PASTURES AND FODDERS OF THE NORTHERN AREAS OF VICTORIA.

By H. Pye,

Principal, Dookie Agricultural College.

Within recent years nothing perhaps has aroused more interest among scientists who devote their time to agricultural problems than the determining of the nutritive values of farm foods—that is, ascertaining how much of the nourishment is available for fat, flesh, and bone-forming purposes, and what would be the best treatment in order to utilize these foods, and to obtain the maximum of good with the minimum of waste.

The part the different constituents of food play, though in general understood, bristles with difficulties, that, even in this progressive age, are not thoroughly mastered, owing to the imperfections of the most perfect chemical laboratory compared with that embraced in the digestive and other organs within the body of an animal.

The feeding of animals in Australia is not considered as of such moment as it is in the old world, where, owing to the conditions of climate, and the cost of the land, a more intense system of feeding and management has to be introduced. The feeding of dairy cows is perhaps the most interesting problem to us in Australia, and especially to the dairymen living in the vicinity of the large centres, where it is necessary to have regular supplies of milk of the best quality. There the land is too valuable, and often too small in area to admit of large herds; hence the dairyman, perforce, must avail himself of the benefits derived from the utilization of condensed foods, in conjunction with the natural pastures, should he find it necessary to keep more stock than his pastures will conveniently carry.

The farmer who enters into dairying with prospects of success has three important objects to keep in view, firstly, his cows must be of good milking strains, both in respect to the quality and quantity of milk they supply; secondly, the food supply must be adequate and rich in milk-forming material; and, thirdly, all those collateral conditions embraced in the word "management," must be attended to in a systematic manner.

The formation of fat in the animal body is a matter of much controversy among scientists. Messrs. Lawes and Gilbert in England, and Gustav Kühn and others in Germany, have done much original work in this direction. It is not probable that this problem of fat formation will be definitely solved for some time to come, owing to the unwearying attention required, the great cost of the apparatus, and the expense of keeping up a staff of scientists whose whole time is devoted to a problem which may take many years to solve.

It will seem then that the solution of problems of the above nature is beyond the province of the ordinary scientific agriculturist, but his time may be devoted simply to feeding experiments on a scale as complete as his conditions will allow. The simplest feeding experiments

are those comparative ones based on the gain or loss in weight of the stock after being fed on certain rations, either of different substances or of varying qualities of similar substances. Such experiments the agriculturist frequently carries out when he has time and capital to do so. If he can employ a chemist to devote his time to the matter, by analyzing and weighing the food, also the solid, liquid, and gaseous excreta, a still more accurate conclusion may be arrived at.

As the feeding value of our pastures is a problem that interests us vitally, and, as pasture grasses vary considerably, it may not be inopportune to devote a considerable amount of space to this important matter.

The dependence of animals on plants is either direct or indirect. In respect to farm animals it is almost wholly direct, and, in the case of pigs and poultry, to a minor degree indirect, since animal food is conducive to their well-being. Plants, as is generally known, obtain their food from the soil, water, and atmospheric air; and, by the action of sunlight, these substances are elaborated into starch, sugar, fat or oil, tannin, albuminoids, &c.

When animals eat the plants, many of these products are utilized, and are broken up to supply material to build up their bodies; thus, it will be seen, in the case of graminivorous animals, if the plants do not contain sufficient of an essential product to build up a certain material or part of their bodies, disorganization must follow, or practically starvation. This may be illustrated in many ways, but it can be conclusively proved by experiment. Owing to the interdependence of the various organs on each other, if one becomes inactive, it does not supply material in a form that a second one depending on it can formulate into nutritive matter, consequently a third organ cannot perform its functions, and finally the whole organization is disarranged, and most likely death will follow; or, as is often the case when partial starvation of a part takes place, the breeding qualities of stock are reduced, and the progeny degenerates.

By analysis it has been proved that plants, in which grasses are particularly included, vary considerably in composition; thus it is possible that the health, development, and condition of stock of one district may be superior to that of the stock of an adjacent district.

The feeding properties of our pastures mainly depend on the dominant species or variety of grass growing on them, yet, not only on this, but also on the fertility of the soil, neglecting the conditions of climate, which we shall suppose to be similar. Certain grasses, under whatever conditions they may be grown, are poor in food-supplying qualities; other grasses are richer, but the relative amount of this nourishing matter will most likely depend on the fertility of the soil, and, in fact, the same conditions in respect to the development of a pasture grass hold as in respect to the development of an animal.

If there be too little potash, nitrogen, phosphorus, or lime in a soil for a certain plant, it loses its vigour, and is forced out of existence by another plant, perhaps a weed, that thrives under less favorable conditions in respect to the missing plant food. If the climate be a moist one, the grasses may have every appearance of excellence, yet,

owing to a deficiency of phosphates, for instance, the stock feeding on them, particularly young stock, will not do as well as might be expected.

It is a matter of common observation that when a hedge or tree is cut back, a young and vigorous growth takes place, and if plants or crops are growing near, they invariably show signs of flagging in their growth to a much greater degree than if the hedge were untouched. From this we can easily deduce that an extra drain has been made on the moisture and plant nutriment in the soil. If now we consider the many prunings the grasses of the fields receive every time the stock pass by, and the increased drain on the plant food within the area influenced by each plant, it will be patent to every one that there must be some limit to this exhaustion; and, when it is reached, the grasses degenerate, and are replaced by plants of less economic value, to the detriment of the stock.

If matured animals alone be fattened, the deterioration of the pastures will be less rapid; but when the products of the farm and the stock reared on it are being sold every day, the exhaustion of the pastures is very marked. It is not alone the exhaustion of plant food that deteriorates the pastures, but overstocking often prevents certain plants from being able to perform their functions, owing to an inherent objection to hard grazing. The remedies are evident in both instances. Top-dressing, with suitable manures in the one case, and less stock in the other. From practical experience I can safely say that a grazing paddock top-dressed with composts or with phosphatic manures, is a splendid stand by, especially for milch cows. Pastures composed of a number of different grasses have some special advantages which are not enjoyed by pastures limited to one or two species. If we take our kangaroo grass it will be noticed that as a gregarious plant, it is, in this district, coarse and little relished by the stock; but, when growing solitary, it affords a splendid bite for all stock, which turn to it as a change from the other grasses; for stock, like human beings, are not averse to a change, and this no doubt is due to a want in the system which is instinctively known, and this is one of the reasons that an animal goes from one kind of grass to another. Thus it will be seen, should we analyze our pastures, that the results expected from the analysis may not be in keeping with the facts, as demonstrated by the condition of the stock; and, again the older growths vary in composition from the younger ones, while peculiar flavours are developed, some grasses being bitter at certain stages of growth. Personally, I believe that, in some respects, the observant agriculturist is better able to determine the relative feeding value of his pastures than the best chemist the world has produced; yet it must be admitted that the chemist is a necessity to agricultural progress, and he has done much to interest the agriculturist in confirming observations, in pointing out causes of failure, and in opening up a wider field for research.

The elementary mineral constituents of plants are not many, in comparison with the number of minerals known, while the elements that form the organic constituents are still fewer, yet the difficulties that arise in determining the part they play in nourishing an animal,

or the part they play in the soil, can only be appreciated by the analytical chemist. Organic matter is a variable and a complex substance, and it plays an active part, chemically and physically, in inducing fertility in soils, hence the reason so much experimental research is devoted to it. We find that the analysis of a pasture grass bears a relation to the analysis of the soil and subsoil on which it grows, but owing to physical conditions playing an active part, and the incompleteness of the best chemical laboratory, compared with the elaborate and perfect one within an animal, only general results are obtained; yet these are sufficient, for the time being, for most practical purposes.

There is one point which is worth considering in reference to our pastures, that is, the richer the soil is within certain limits, the longer do they keep green, other conditions being equal. From experiments carried out here during the last few years, this result is noticeable, especially if the surface soil be not shallow. Some of the grasses kept green during the last two seasons, whilst the Texas Blue grass I have grown for several years has always remained green during winter and summer, although during midsummer the dried stalks predominated, but as soon as the autumn rains came the grass made rapid growth. Unfortunately, this grass is difficult to propagate from seeds, though it may be easily propagated from root cuttings. It cannot be said to have had a convincing trial, except as regards to permanency of growth, yet the sheep, during the drought, used to paw it out of the ground and eat the succulent underground shoots.

An interesting experiment was carried out last season with one of the indigenous grasses, viz.:—Wallaby grass (*Danthonia penicillata*). A small plot was top-dressed with bone-dust, and another plot was not manured. In the latter plot the grass dried up as soon as the hot weather had set in, or just a little after similar herbage in the paddocks; but that which was top-dressed kept green for six weeks longer. Visitors who saw this grass, and particularly farmers, were struck with the fine sward presented, and wondered what that fine grass was, expecting it to be some rare foreign introduction instead of what it really was—our own indigenous wallaby grass—treated with a little more generosity than usual. Thus, I say, in respect to the northern districts, treat your indigenous pastures well, and you will find that you have the safest stand-by for your stock in time of drought, for their feeding value will be superior, and their permanency will be assured.

Every grazier who is successful in the drier parts of the country keeps one or two paddocks for topping off his stock for the market, or as a stand-by for some future part of the year: but, as a rule, he confines the better treatment to the one paddock, as if it had an hereditary right, consequently it thrives apace, while the neighbouring paddocks become poverty-stricken from the continuous drain on their resources. There is no greater mistake made than to neglect the rule of rotation with pastures, and no easier way to be assured of their success than by attending to it. Unfortunately want of capital prevents many agriculturists in a new country from carrying out a proper rotation

owing to the cost of subdivision fences and manures; but, as far as the means will allow, the nearer the grazier approaches to the carrying out of a system of rotation suitable for his district, the more likely is success to follow.

A simple rotation, where it is not possible to manure, would be to rest the pasture paddocks alternately, to allow bare patches to fill up by seeds formed, and if sheep have been running over the paddock let the horses or cows graze over it for a season, since they will not be so severe on it. A rotation of stock on a pasture is certainly worth considering more earnestly than it appears to be. An occasional harrowing of the pastures, where possible, gives good results, as I have found from experiment.

Now that the manuring of crops has become a general practice, it will be interesting to note, in the course of years, what effect it will have on the pastures, should the land be thrown out of cultivation for a time. There is no doubt but that an improvement would be noticeable, could a comparison be made. As an instance of the effects of residual plant-food in soils that have been manured, there is one case that came under my notice which may be of interest. Some twelve years ago a series of manurial tests were carried out in a field by a former Principal, and, after the first year, were discontinued. Whenever this field was cropped since then, the effects of the original dressing of manure on the plots were very marked, especially where the heavier dressings of phosphatic fertilizers had been applied. The plots not manured could be easily distinguished from most of the others, although some of the manured plots did not show to advantage against the unmanured plots. The former plots, from what I could learn, were those dressed with nitrogenous and potassic manures only. The effects of the residual plant-food from the original dressings of phosphatic fertilizers given twelve years ago are apparent to-day. This is only one instance of many, but it extends over a longer period of time than the others that have come under my notice here. Thus the outlay of a farmer in purchasing phosphatic fertilizers is of lasting benefit to him. He reaps the reward of his enterprise not only during the first year, but for a decade or more to come, and with a little observation this will be apparent in the future crops; or, if the land be out of cultivation, in the better stock-carrying capabilities of the pasture.

Silver grass (*Festuca bromoides*) has very poor fattening qualities, especially when old, but it has the virtue of being early and a most prolific seeder, so that it does not take long to overrun a b re paddock and afford a bite for stock. The Sterile Brome (*Bromus sterilis*), by some called Spear grass, although this name really should be applied to the Stipas only, is another common annual of little value, and one that covers a good deal of country in local spots. Other bromes are also much in evidence, and, unlike Prairie grass (*Bromus unioloides*), are of little value.

Barley grass (*Hordeum murinum*) is another annual that is rapidly gaining headway, owing to its free seeding nature. This, like most of the annuals mentioned, has the one good quality of being early; otherwise

there is nothing to be said in its favour, as the awns are most troublesome when the plant is matured, and so are those of the sterile brome, which, with the above-mentioned grasses, are introduced species. The ornamental Quaking grass (*Briza minor*), a useless introduced annual, is also becoming more general. Another ornamental and pretty little annual is the *Aira caryophylla*, which is indigenous to the country. It is still more useless as a pasture grass than the others, and is very frequently seen in the Goulburn Valley.

Within the last fourteen years the Goulburn Valley, and especially the districts around Dookie, Goorambat, Benalla, and Pine Lodge, where I have had more chance of observing the pasture grasses, some of the best cattle grasses have almost disappeared; in fact, during the last ten years I have not been able to find a specimen of a few of them where, at one time, they appeared in local spots as if they had been purposely sown by the grazier, the sward being so thick. The more general introduction of sheep on the farms and the increasing area given over to the plough, combined with the dry seasons and overstocking, have a good deal to account for in the deterioration of the pastures of the northern areas of this State.

As it has been previously pointed out in this paper, the pasture grasses are almost wholly composed of free seeding annuals, except perhaps where the plough has not yet turned up the land, and where a fair proportion of perennials may still be noticed, usually Wallaby grasses (*Danthonias*), Spear grasses (*Stipas*), Kangaroo grass (*Anthistiria ciliata*), Windmill or Umbrella grass (*Chloris truncata*), and Tussock grass (*Poa caespitosa*).

The Danthonias or Wallaby grasses are the most important of our perennial pasture grasses. There are several species and varieties to be found in these districts. The varieties of Wallaby grass (*Danthonia penicillata*) growing in the better class of soil are not so coarse, nor do they grow so high as those found on the hills, where the soil is poorer. There is one variety which reaches a height of from 4 to 5 feet, and which is easily recognised from the smaller varieties by its red stamens. I classed this as a variety, as it was always named by the late F. von Mueller as *Danthonia penicillata*, along with the more common and better-known Wallaby grass, yet it appeared, except perhaps in the structure of its florets, very unlike the latter.

The Stipas or Spear grasses were at one time very much in evidence in these districts, and at present *S. crinita* and *S. scabra* are, next to the Wallaby grasses, the most abundant of the perennial indigenous grasses. *Stipa semibarbata* and *Stipa aristiglumis* are now scarcely ever seen, although so abundant twelve years back. Their awns are most objectionable to sheep, as are also the awns of the others mentioned.

In parts of the district the Three-awned grass (*Aristida Behriana*) is on the increase. It is a rather low-growing perennial of a coarse nature, and somewhat later in ripening than the Stipas, and, like them, has troublesome awns.

The Kangaroo grass (*Anthistiria ciliata*) a little more than a decade back could be seen growing and having every appearance of a good hay crop, yet I do not think in this district it seemed to be much

relished by the cattle, as it appeared harsh and coarse. The solitary clumps of it, however, were well grazed, and afforded a good bite for stock in summer. Unfortunately this grass does not withstand the close grazing of sheep, and it has remarkably poor seeding properties.

At the same time as the Kangaroo grass flourished in this district, I saw on Mount Major a splendid cutting for hay of the Blue grass (*Andropogon sericeus*), which stock of all kinds appeared to be very fond of. It grew from 18 inches to 2 feet high, and it seemed as if the seed from which the crop had sprung had been sown purposely. I have scarcely been able to find one specimen of this during the last eight years. Although it is said by some to withstand hard grazing, it did not appear to do so in the case that came under my notice. The Australian millet (*Panicum decompositum*), at one time fairly plentiful, is now very scarce. It is a very good fattening grass, and in moist places I have seen it 5 feet high, but in ordinary pastures rarely more than 8 or 9 inches high. It seems more suitable for a climate with a better rainfall than this, yet it would be well worth experimenting with.

The Tussock grass (*Poa caespitosa*), when growing near swamps, lakes, and river banks, is invariably coarse, and not suitable for cattle, although it affords a bite when young. That growing singly or on the hill pastures seems to be liked by stock, as it appears well grazed.

Of the remaining grasses that were at one time fairly common in these districts, we have the following list:—Meadow Rice grass (*Ehrharta stipoides*); Love grass (*Eragrostis Brownii*); the Bent grasses (*Deyeuxia Forsteri* and *D. quadriseta*); Pappus grass (*Pappophorum commune*); Incurved Lepturus (*Lepturus incurvatus*); Blue Wheat grass (*Agropyrum scabrum*).

Meadow Rice grass seems to have a good reputation. Here it could only be found in the sheltered glades and grassy gullies of Mount Major; whilst Love grass, with its purplish panicle, was common to the flatter country. This latter seemed to be much liked by stock in parts where the land was good, but in the more sandy soils, towards St. James, it had every appearance of being of a harsher nature, and was not so well liked. Pappus grass was confined to Mount Major, and grew on the rocky parts. It could be recognised from the others by its slate-coloured cylindrical head.

Among the aquatic grasses common to these districts, and to many of the northern areas, are Swamp Wallaby (*Danthonia nervosa*), *Diplachne loliiformis*, *Chamaeraphis spinescens*, and the Knee-jointed Foxtail (*Alopecurus geniculatus*), which is found almost all over the world.

The *Chamaeraphis spinescens* grows along the banks of lagoons and tanks, and its long shoots may often be noticed floating on the surface of the water. The above aquatic or semi-aquatic grasses are named in order of their importance, as demonstrated by my observations with regard to stock grazing on them. None of them are first-class grasses, but they supply a gap in the pastures that could not otherwise be conveniently filled.

Rough grass (*Echinopogon ovatus*) used to be plentiful near the Broken River, and I have seen it growing among the thicker undergrowth near the Goulburn. It does not appear to be relished by stock, as its stems and heads are so rough.

Having given a short account of the principal indigenous and acclimatised grasses of these districts, it may be interesting to make a few observations in respect to other plants growing in our pastures. Thus the effect of hard grazing for a number of years together are not only evident in the dying out of the natural grasses, which are often supplanted by weeds, but we may observe that nature in carrying out a rotation, just as the farmer is frequently advised to try, in growing leguminous crops to add vegetable matter and nitrogen to the soil. During the last decade the increased growth and dissemination, by means of sheep and cattle, of various clovers over the pastures is apparent to the observant agriculturist, and this statement is supported by the fact that when perusing the inquiry columns of the weekly papers, we find that the editors of the agricultural branches are continuously giving information, and naming specimens of clover sent for identification, such as the Medick burr or Burr clover (*Medicago denticulata*), Woolly trefoil (*Trifolium tomentosum*), the Strawberry clover (*Trifolium fragiferum*), *Trifolium subterraneum*, *Trifolium glomeratum*, and a few others.

The grasses, clovers, and herbs, when they die down, supply the much-needed humus or decomposed vegetable matter to our soils, and especially to those of our northern areas which are often deficient in it, and so encourage the absorption of moisture from the air, while it also acts as a natural mulch, during the hot seasons, to the living grasses and plants.

Often times we see bare patches of soil devoid of grass, clover, or other plants, though mosses and such low forms of plant life may sometimes be endeavouring to cover the blanks. These patches are frequently less fertile when cropped, and the cause no doubt may be owing to the deficiency of organic matter and to the absence of plant food-producing germs; while, again, the rank-growing patches of Burr clover in the fields, when ploughed under, often account for the extra luxuriance of some patches of crop other than where the ashes from the burning off have been lying.

It is inevitable that all the better land, and much of the inferior, will, in the course of a few years be given over to the plough, thus curtailing the area of the original permanent pastures. Ultimately the farmers of the northern districts will reach that point when they must seriously think more about their pastures than they have done in the past, and thus the question of growing annual forage plants will appeal to them with much more force than has hitherto been the case. Since the annual grasses that cover old cultivations have been shown to be of much less nutritive value than the indigenous pasture grasses, thereby reducing the stock-carrying capacity of the fields, it will be necessary to devise means in order that this loss may be made good. In the first place smaller paddocks are to be recommended, and, in general, better provision should be made for watering the stock.

The smaller paddocks give a farmer every opportunity of carrying out a rotation of fodder crops in order that his stock, especially his milch cows, should have good succulent food throughout the summer and autumn, when the ordinary pastures are too dry and bare. During exceptionally dry seasons silage, hay, and straw will come under greater contribution, but this may be minimized as a rule by growing more annual fodder crops, of which the many varieties of Sorghum offer a good choice, and of them Early Amber Cane is one of the best, whilst its milk-producing qualities, when fed to cows, are undoubtedly high. Millets to a minor degree are also good autumn fodders, as with a little rain they quickly supply useful feed when young, although during such an autumn as we have just experienced, these plants are not to be compared with Sorghum for drought-resisting properties, and are merely to be used as catch crops.

Maize does not succeed well in the northern climate, it being too dry; yet in a rich, well-prepared, deeply-ploughed field, during most seasons, a very satisfactory amount of fodder may be grown, on which the cows could be turned whilst the sorghum is ripening, and the sugar is forming in the stalks.

At the college farm the calves are pastured on the maize crop, and during a good part of the summer thrive well on it. By the time the maize is finished they are not averse to the sorghum, and, although neither they nor the cows relish the latter like the maize, still both do well on it, and do not suffer any ill effects, as is sometimes the case when the cows in poor condition are turned too suddenly on to it.

Barley sown early in the year for autumn feed has scarcely had a chance of late years owing to the droughts. It, however, comes on later in the season, and could be either grazed off by pigs or cut when sufficiently high for green fodder.

Of the introduced grasses that supply abundant fodder when growing under suitable conditions, Golden Crown grass (*Paspalum dilatatum*) has had no small share of attention, and deservedly so, but no mistake must be made in thinking that it will be suitable for all conditions of soil and climate. It grows to perfection in countries possessing warm moist climates, it gives excellent results in temperate parts where the rainfall is fairly good, but in most of the soils of the northern districts where the rainfall is slight the plant is practically of little use. I have tried it here for ten years, and now only grow it experimentally. I consider that it is a valuable grass to plant in local spots in the northern parts, where its penetrating roots may reach a moist subsoil but otherwise I feel satisfied that it will not be a practical success, notwithstanding the fact that it has such good drought-resisting properties. I would much sooner put my faith in Early Amber Cane for the northern districts, even though the former takes a good deal out of the soil, which, however, can be replaced by artificial fertilizers.

During frosty weather the Paspalum makes little or no headway and so it cannot be relied on here as a winter grass. When first planted it sometimes does well during the first season, and perhaps the second, if the rains are favorable, but otherwise it has not succeeded

here. In places where it flourishes, a farmer could well afford to have a few small paddocks of it, and graze his stock alternately on each. In preparing the land it is better to subsoil before planting, especially when the rainfall is limited. Top-dressing and harrowing, when needed, rejuvenates the grass, and extends its usefulness over a longer period. An advantage this grass has over others, such as Johnson grass and Couch, is that it may be more easily killed when ploughed under in order to utilize the paddock for cropping.

Johnson grass I consider is almost a weed on a farm, and, although it is a splendid drought-resisting grass, stock do not appear to relish it, especially during the early part of its growth. During its first season it is very vigorous in its growth; but as soon as the soil becomes hard, from cattle grazing on it, it makes little headway, although the succulent underground stems thrust up shoots as vigorously as ever as soon as the paddock is scarified and harrowed, and especially if top-dressed. Even in the driest climate it is difficult to get rid of this grass when the land is needed for other crops. It dies down as soon as the frosts come, but shoots up again with the return of the warm weather.

A few seasons back a 40-acre paddock was sown with various mixtures of grass seeds, including those of all the better-known species. The results were not at all satisfactory, and none of the species survived the dry summer. We have had such a succession of dry autumns that seeds of any kind can scarcely be said to have a fair chance. A slight rain may fall sufficient to germinate a few of them, then follows a protracted dry spell, resulting in the withering of the delicate plantlets.

When the early autumn rains have been good, I have seen, on the farm, excellent results with Italian rye grass and Crimson or Italian clover; these are both annuals. The White, Red, and Alsyke clovers, also Cow grass, Birdsfoot trefoil, and Japan clover were not a success, neither were Sulla, Serradella, or Sainfoin. Lucerne, though not suitable for the soils of this farm, is beyond doubt the most successful of the leguminous fodder plants. If this land is not subsoiled and well worked and manured the lucerne soon degenerates and dies out.

Cow peas are a partial success, and during some seasons give a good deal of fodder. It is possible that a variety may be formed that will in every way suit the northern conditions. The cow pea is an annual, and so cannot be of service in permanent pastures. Both the early and late varieties resist the dry summer, and if good rains fall during February and March their haulms soon cover the ground very thickly, and as soon as the frosts come will die. The seed is rather expensive at present; and this, in some respects, is due to the difficulty in gathering it. Only one or two of the early varieties form sufficient seed to make it worth while gathering it for home use, the others being too late, though of a more luxuriant growth. The pods are edible, and in some parts are eaten as a vegetable. I have used the Cow pea with success as a green manure, and, in other parts of the world, it is cut for hay.

Lupins grow fairly well, especially if the autumn rains are good, and the seed is sown soon after them. The same may be said of the Spanish lentils, which are, however, more subject to the effects of frost. The German and Egyptian lentils do not thrive as a rule, since the spring is too short, and there is usually too little rain during the early summer. Through the kindness of Captain Currie, of Melbourne, I received a number of seeds of leguminous and other plants from Dr. Caddy, of India. Of these I shall report later on, when I shall give the results of other experiments with plants, together with more detail in respect to some already noted in this paper.

GREEN MANURE FOR DRY DISTRICTS.

A plentiful supply of humus, or decayed vegetable matter, is one of the chief requirements of a soil; but to maintain this in the dry northern districts, especially where irrigation is practised, is often a difficult task. Continuous cultivation under the latter conditions soon tends to exhaust the humus, and, as a consequence, the physical properties of the soil are changed for the worse—it is less retentive of moisture and heavier in weight. By turning under a green crop these drawbacks can be overcome, the main difficulty being to secure a plant capable of making a sufficiently heavy growth in the winter, so that it may be ploughed in about the end of August. So far, it would seem that the best results have been obtained with Cape barley sown in April, though peas in a few isolated cases have answered fairly well. The latter, however, are subject to the drawback that, by the time they are ready for turning under in the spring, the season is usually so advanced that the benefit to the soil is largely counterbalanced by the difficulty of ploughing owing to the hardness of the ground.

In the State of Arizona, U.S.A., similar troubles have been experienced, and much patient work has been done at the University Experiment Station there by the Agriculturist and Horticulturist, A. J. McClatchie. In a leaflet, entitled *Timely Hints for Farmers*, No. 36, November, 1901, the subject is dealt with in a popular manner, and attention drawn to the great success obtained by using the "Sour Clover" (*Melilotus indica*) as a winter green crop. In contrast to Lucerne, which only grows in the warmer months, the Sour Clover finds the most favorable conditions for its development in the colder period. Its chief value is as a soil enricher, the turning down of the heavy growth made in the winter being an excellent method of adding humus, and with it nitrogen, to the soil. Mr. McClatchie, in answer to some inquiries by the writer, stated that the usual practice was to sow in October and November, corresponding to April and May in Victoria, the ploughing down being done just when the apricot blossoms are beginning to open. Unfortunately, the seed sent by request has miscarried, and none appears to be obtainable at present in Melbourne, but next season a full supply will be available for trial.

PURITY OF AGRICULTURAL SEEDS.

During the past few seasons a considerable quantity of lucerne seed has been supplied to farmers containing a large proportion of dodder, and, similarly, purchasers of rye-grass seed have been victimized through the presence of ergot. It would, perhaps, not be fair to characterize the selling of such seed as a deliberate fraud, since it may be that the merchant was entirely ignorant of the nature of the article. But such ignorance on the part of dealers in seeds should no longer be allowed to continue, and steps should be taken without delay to make it compulsory that all seed merchants should at least guarantee lucerne and clover free from dodder, and rye grass from ergot.

Recently the Board of Agriculture in Britain appointed a committee, composed of leading scientists, seed merchants, and farmers, "to inquire into the conditions under which agricultural seeds are at present sold, and to report whether any further measures can with advantage be taken to secure the maintenance of adequate standards of purity and germinating power." The committee included the Earl of Onslow as chairman, Sir Jacob Wilson, Sir W. T. Thiselton-Dyer, and Mr. Leonard G. Sutton. A large number of witnesses were examined, fully representative of the seed merchants, farmers, and scientific men, and the Report presented to Parliament is of considerable interest to producers.

The following extracts from that Report are worthy of attention:—

2. Your Committee have made careful inquiry into the conditions under which seeds are now sold, and find these conditions vary considerably in different parts of the country. There appears to be a consensus of opinion on the part of the witnesses that no difficulty is experienced by farmers of education and position in obtaining good and reliable seeds from reputable seed merchants. On the other hand, it is generally admitted, both by seedsmen themselves, and by farmers who appeared before the Committee, that a quantity of inferior seeds is sold throughout the country, especially in the West and South of Ireland—seeds of low germinating power, old seeds, and seeds that have not been properly cleaned; these for the most part, find their way into the hands of small merchants, such as corn chandlers, ironmongers, publicans, and others, whose main business is of an entirely different character.

9. The rise and spread of co-operative societies has done much to improve the condition of the Irish farmers. There is now scarcely any county in Ireland which does not contain several co-operative societies. Their members obtain supplies of seed through the local branch. That branch makes a contract for the supply of seeds by some reputable merchant, who is willing to guarantee the purity and germinating power of the seeds sold.

26. The presence of dodder in clover or flax, or of ergot in grasses, should condemn the sample without any other consideration.

35. The existence of a public testing station would probably lead to an increase in the number of seedsmen willing to guarantee their seeds, inasmuch as it would supply a ready court of appeal to which both vendor and purchaser could refer. A seed merchant selling under a guarantee would be

able to submit his seed to be tested before sale to the same expert as the purchaser would employ after making his purchase. It might therefore be fairly expected that a test conducted by the same person under similar conditions would not materially differ on two separate occasions.

40. The practice of guaranteeing the purity and the germination of seed by seed merchants appears to be increasing. Nor does it appear that those who guarantee their seed find it necessary to charge a higher price than those who do not. . . . . . . There seems no reason, in the opinion of the Committee, why any good seedsman with ordinary care should not be able to give guarantees of purity and germination without injury to his business or undue risk to himself. Indeed, many of those who do not make a practice of giving guarantees stated that if asked to do so, they would have no objection to comply; while one witness expressed the opinion that the question of guarantee was merely one of price, and that an addition of 5 per cent. in the case of clover and 10 per cent. in the case of grass seed would suffice to cover the risk which the vendor would incur.

48. While your Committee are not prepared to recommend that any legislation should at present be enacted, making it compulsory to sell, subject to guarantees of germination and purity, they are of opinion that agricultural societies and others should do what lies in their power to encourage farmers only to buy their seed subject to guarantees of purity and germination; to have special regard, when purchasing, to weight as well as measure; and to insist on the importance of having seeds so purchased tested to see that they are equal to the standard guaranteed.

Part of 51. The Committee are of opinion that in secondary and other schools which farmers' sons frequent, a practical turn to any teaching of botany might, and indeed should, be given by a systematic study of the character of grasses and forage crops, coupled with microscopic examination of their seeds and experiments in testing their germination.

They think that every encouragement should be given to seed merchants to give a guarantee with the seeds they sell, and that farmers should be advised to buy only subject to such guarantee, and to test the seeds they have purchased. In order to reduce to a minimum all difficulties in the way of such practice, they recommend the establishment of one central seed-testing station, under Government auspices, whose practice and procedure should be laid down and from time to time revised by a small committee of experts. The charges at this station should be moderate, and so fixed that seed merchants should be encouraged to sell subject to free re-testing of their seeds by the purchaser, should he desire it.

The small farmer can if he chooses follow the example of the more intelligent and enlightened of his class, for even the small dealers would soon take to the retailing of only those seeds which were guaranteed by the wholesale merchants if there were no sale for any other.

CHEMICAL BRANCH.

RESULTS OF MANURE EXPERIMENTS, 1901-2.—
(continued.)

By F. J. Howell, Ph.D.

A Criticism of the Results of the Experiments.

NHILL—KANIVA GROUP.

The returns from the three districts included in the list are among the most satisfactory of those obtained throughout Victoria. They offer in their beautiful regularity evidence of the most careful working on the part of the farmer, and the thanks of the whole district are due to the men who at some inconvenience, cost, and extra labour to themselves co-operated with this Department and carried the work through so successfully. It is specially gratifying to myself that the results in this district have turned out as they did. This was the portion of the State where my earliest efforts were made to introduce the teachings of this branch, and the kind reception I met with from the farmers at a time when the prejudice against such teachings was rather prominent helped me to carry out the duties that had been allotted me. My second lecture in the State was delivered at Kaniva, and the later ones followed in order down the line.

The results of 1901 are in almost every way confirmatory of those obtained in the preceding year, with the exception that in plots 10 and 12, where nitrogen has been applied, the crops appear to have suffered less injury this year than the preceding. In the experiments of the former year the returns from the plots where sulphate of ammonia was used in conjunction with a superphosphate were somewhat below those where superphosphate alone had been applied.

In the returns under review the yields on the nitrogen plots 10 and 12 are, taking the general average for the three districts, just a trifle better than plot 6; but the difference is not of so marked a nature as to justify us in thinking the soils would receive any appreciable benefit from the addition of nitrogen.

The superphosphates in the present experiments have throughout shown a greater superiority over Thomas phosphate than in the preceding year, giving an increased yield over the latter of nearly 2½ bushels. The returns from plots 3 and 6 are what they theoretically should be, practically identical, for both these manures contain equal quantities of phosphoric acid. On plot 4, where the maximum dressing of phosphoric acid has been given in the form of 33 lbs. of concentrated superphosphate, equivalent to about 76 lbs. of ordinary, there is an appreciable increase over plot 3, which justifies one in thinking that the full application might be profitably applied through the greater part of the district. In the Diapur returns the lighter application appears to have met all requirements.

Taking the general average increases of the three groups in the experiments under review, it will be observed that these are greater in nearly all cases than for the preceding year. In the last year's experiments there were in certain of the plots slightly larger quantities of manures used than in the preceding year. This, perhaps, partly explains the difference. The fact of the larger increases, however, is of some value, considering the exceptionally late and dry season we experienced last year. The effect of the unfavorable season is reflected in the lower yields from the unmanured plots compared with those of the preceding year. The average of the unmanured plots of the first year's experiments worked out at 8·79 bushels. The average for the last year's plots are less by more than three-quarters of a bushel. That such results should be obtained from manures in a dry and unfavorable season will do much to dispel a belief at one time common among farmers that it would only be possible to use manures with any good effect in seasons of a heavy rainfall, and that in a dry year harm rather than good might be expected to follow their application. One point, however, I would bring prominently forward, that is, that most of these plots were put down on a well-worked fallow, and to this fact is due a great part of the success.

Each District in Detail.

Kaniva.

These returns are full of interest, and in places astonish one by the remarkable yield obtained on some of the manured compared with the unmanured plots. This is notably the case in the returns of Mr. Tweedie. The average of the five unmanured plots on this field works out at 3·81 bushels only, a crop hardly worth harvesting, while on plot 4, for an expenditure of 4s. per acre only, the yield has been lifted to 16·58 bushels, with an increase of 12·08, and on plot 28, where 1 cwt. of manure has been used, the marvellous increase of 18·59 bushels has been obtained. The results were so unusually large that Mr. Tweedie was specially written to asking perhaps if an error had not been made. But his reply gives thorough confidence in the accuracy of his results. In fact, four out of the six soils experimented on in this district appear to have been of an exceptionally poor nature, and to have responded well to the application of manures even in quantities up to 1 cwt. per acre. The poverty, however, appears to have been one of phosphoric acid only, as an addition of potash on plot 21 tested in the case of Mr. Eastwood seems to have produced no increase over plot 10; while, as far as nitrogen is concerned, an addition of this ingredient in the shape of either sulphate of ammonia or dried blood produced in none of the soils, with the exception of that of Mr. Tweedie, any very appreciable increase in yield. The application of gypsum in conjunction with a superphosphate appeared inoperative in the case of Mr. Bateson. The soils, then, of this district may be regarded as being sufficiently provided with nitrogen, potash, and lime, but particularly poor in phosphoric acid.

THE DIAPUR EXPERIMENTS.

There is nothing calling for special remark in the returns of this district. The regularity in the returns from the unmanured plots in the several instances gives evidence of very careful working, and is a guarantee of accuracy. The heavier dressing on plot 4 appears in this district to have been much less effective than on the soils of Kaniva. The returns on plot 3 showing the same increase practically in yields. Like the soils of the district just dealt with the prominent deficiency of the Diapur district stands out clearly as phosphoric acid, as neither an application of nitrogen, potash, or lime on the plots assigned for making the tests gives any evidence of very appreciable benefits following, at least, not to an extent justifying their use as a profitable operation.

THE NHILL FIELDS.

The Nhill Agricultural Society offered from the first the warmest support to the experiments carried out by this branch. The president (Mr. Fraser) and the secretary (Mr. Towns) doing everything possible to arouse and maintain interest among farmers. The manner in which the farmers of the district have responded must be highly gratifying to them. The returns from the two years' experiments show very plainly that the soils of the district respond well to the action of phosphoric acid when given in the soluble form of the superphosphate. The average increase in yields due to manures are not quite so high for the last year as the preceding, but are sufficiently so to indicate the highly profitable nature of manuring. An examination of the returns on plots 1, 3, 4, and 6 will offer in this respect some interesting information.

Value of Increased Yields due to Manure.

	s.	*d.*
Plot 1—		
4·10 bushels, at 2s. 6d. per bushel	10	3
Cost of manure	1	4
Profit per acre due to manuring	8	11
Plot 3—		
5·47 bushels, at 2s. 6d. per bushel	13	8
Cost of manure	2	8
Profit per acre due to manuring	11	0
Plot 4—		
7·05 bushels, at 2s. 6d. per bushel	17	1
Cost of manure	4	0
Profit per acre due to manuring	13	1
Plot 6—		
5·75 bushels, at 2s. 6d. per bushel	14	4
Cost of manure	2	2
Profit per acre due to manuring	12	2

The Use of Phosphatic Manures Over Long Periods.

This is a question that now deserves consideration, and I have solicited the co-operation of some farmers in the district who will be willing to continue manure experiments on the same ground over a long period of time. We have found from our experiments that an application of a phosphatic manure only is as yet the only requirement of the soils of the district for the production of large and profitable crops. But it behoves us to look beyond the present into the future, and anticipate as it were the possible wants of years to come. It is only from the comparison of results over long periods of time that we shall discover if the manures we now apply are the only ones ever likely to be needed under present systems of cultivation, or whether, after some little time, our soils may not ask us for something more than the phosphoric acid which at present seems all sufficing.

Warracknabeal, Minyip, and Murtoa Fields.

(1) Minyip Group.

It is only some two years ago that the farmers of the Minyip district began to take an active interest in the question of manuring. With a soil, generally speaking, of excellent quality, and a system of careful cultivation, crops had been obtainable for many years large enough, apparently, to prevent any great wish for anything much better. The idea seemed general that nothing added to the soil, beyond perhaps a little more moisture occasionally, could produce anything better than was being obtained. The farmers, for the greater part of German origin, who had settled in the district, had brought with them the thorough careful methods of the race, with a good deal, perhaps, of its proverbial conservatism, and I found on my first visit to the district that, although the system of the bare fallow was general, and the value of a proper cultivation of the soil everywhere admitted, the advantage of manuring found few supporters and little sympathy. It was almost solely due to the interest of Mr. Heckle, secretary of the society, and Mr. Barnes, an active committee member, that some eight or nine farmers were induced to accept the offer of our branch to conduct experiments in manuring. The results of the tests were of such a satisfactory nature that on my second visit to the town, I found half the district enthusiastic converts, and the greater portion, perhaps, of the other half favorably disposed. I think with the results of our second tests before them, that the prejudice of the few remaining opponents may be now completely beaten down.

A Bad Year and Good Yields.

I think the eight names on the list of this year are those of good representative men, in no way falling behind the average farmer of the district either in quality of soil or methods of cultivation, and yet in the season we have just passed through neither average soil nor approved farming methods would alone have secured them yields which might be considered really profitable. Taking the average of the unmanured plots we find that these work out at only 9·97 bushels, compared

with 15·35 of the preceding year, a difference of $8\frac{1}{2}$ bushels. While on plot 4 we find a yield of 15·47 bushels, an increase of more than 55 per cent. The unfavorable season of last year has manifested itself in the lower returns of all the plots under review compared with last year's. The unmanured plots in the first experiments show an average as stated above of 15·35 bushels compared with 9·97—the plots treated with phosphatic manures averaging in the first case 20·72 bushels, and in the second 14·15. The average of the increases due to manures on the first five plots of the first experiments figure out at 5·08 bushels, and on the second at 4·40. In the nitrogen plots of the present year, 10 and 12, there appears to have been a slightly better increase produced than formerly, but not to an extent to make us believe that the soils generally are in any need of nitrogen. The results right through may be considered as thoroughly confirmatory of those of the preceding year. The soils respond to phosphoric acid as their only requirement, and the superphosphate among the phosphatic manures has shown itself the most effective.

An examination of the special plots 13, 18, 19, 21, and 33 reveals points of interest, and are in part confirmatory of the statement just made as to the limited deficiencies of the soils of this district. In plot No. 13, where an application of gypsum has been made in addition to the phosphatic manure contained in plot 3, there is an increase of 3·91 bushels compared with 4·67. The gypsum, therefore, has proved ineffective, and there has been no further response by the soil to the other plant food contained in the gypsum, that is, lime (calcium). That the soils of the district are sufficiently provided with this ingredient is further indicated by the returns on plot 19, where 1 cwt. of lime has resulted apparently in a slight loss. In plot 21, where potash has been applied in addition to the nitrogen and phosphoric acid given in plot 10, a comparison with the latter reveals the fact that here also there has been a slight reduction rather than an increase in yield, and we may draw the conclusion in full confidence that the soil of this farm, and in every probability of the whole district, is so well provided with potash that it would be useless making further additions in the shape of manures containing this ingredient. The carrying out of the operations on plots 16, 18, 31, and 33 had naturally to be left to the farmer, and I have not yet confirmation of this having been done. As the figures now stand it appears that the superphosphate given as a top-dressing after the crop had come up produced on plot 16 an increase of 5·01 bushels, falling behind the application of the same quantity of manure by the drill on plot 6. The sulphate of ammonia, given as a top dressing on plot 18, compares also very unfavorably with the drill application on plot 10. Plots 31 and 33 were to be horse-hoed. Providing this has been done, and I have no proof yet that this is so, cultivation alone in the last plot resulted in an increase of more than three-quarters of a bushel.

The Necessity of Further Experiments.

The plots in their present form have perhaps served their object in this district, but all the problems in connexion with the question of manuring have by no means been solved. There is still the matter

of the effect of the continuous use of the purely phosphatic manures to be tested by means of experiments continued on the same plots for a long number of years. *We require on one of the farms in the* district a permanent field, with a farmer who will sacrifice some little time and take some little trouble. The suggestion has already been made by me that the society should solicit the assistance of such a farmer to undertake the work, and I have no doubt that suggestion will receive attention.

The Warracknabeal Group.

It has been my experience in nearly every district that the introduction of all reforms in agricultural practice has depended upon the interest and energy of two or three men, and I owe my special thanks in the case of Warracknabeal to Mr. Schickerling, late president of the society, and Mr. T. G. Bennett and Sons, members of the committee. At a time when it excited little else than ridicule to preach improved methods of farming and the use of manures in the mallee, these gentlemen gave me personally their heartiest support, and held out helping hands to my late chief. It is gratifying to me that the very indifferent results of the first year's tests did not take away their faith in the possibilities of science to lift the agriculture of their district to a higher level, and that this year the demonstration of its truth has been made at their own doors. The year of the first experiments was an unfavorable one for us. There were no early rains to start the rubbish, but the crops were nevertheless got in very early, with the result that the rubbish came after and choked everything else out. Last year we started under more favorable conditions. The returns, as far as the increases due to manures are concerned, are of a highly satisfactory nature, especially on plot 6, where, for an expenditure of 2s. 2d. only, an increase of over 5 bushels has been secured. The ordinary superphosphate has proved the most effective, as evident on plot 6, and would probably had an additional 15 or 20 lbs. been applied given correspondingly increased returns. This appears evident on plot 4, especially in the case of Mr. T. G. Bennett. Thomas phosphate has in both cases given considerably lower yields than the superphosphate, while the returns from bone-dust are in both cases on the unprofitable side. The increased yields on the nitrogen plots are in both cases noteworthy. Both these fields were, I believe, on mallee. It is possible these lighter soils of the mallee may give earlier evidence of the necessity of nitrogen than the heavier soils of the State, field experiment alone will answer the question.

The Banyena Experiment.

The experiment carried out by Mr. John King, of Banyena, is the only one that might be included in the Murtoa district. In the experiments of the first year there were nine fields in the Murtoa group, giving a very fine average yield. The requirements of the soils, as indicated by the tests of both years, differ in no way from those of our wheat-growing area. In fact, the unbroken uniformity in results obtained on the soils of this portion of our State would

almost seem to justify a neglect of the criticism of the returns of each district or group of districts in detail for a summary of the aggregate returns, the conclusions on which might apply to each district individually. It must seem strange to the farmer to be told that his particular property, showing such apparent differences of soil even within its own boundaries, and probably much more pronounced ones compared with adjoining holdings, differs in no marked way in its material aspects from the wants of every other soil, not only in his own immediate neighbourhood but in the half of Victoria, and yet our experiments teach us such, and indicate that the spreading of a few pounds of phosphoric acid in an appropriate form on a soil condemned *universally as of little agricultural value, may lift such a soil to almost* the same level of productivity as one perhaps commanding several pounds per acre more in the market. Apparently the whole reason of the greater unproductivity of the one than the other depends upon the shortage in a more marked degree than the other of one ingredient —which in none appears to be present in the quantity that it ought to be. The deep red of one soil, the chocolate of another, the black colour in the third, the stiff texture of a fourth, and the light loose character of a fifth are all associated in the popular mind with differences in degree of fertility. The popular view is no doubt to a great extent a correct one, but it appears that in our soils of Victoria the addition of phosphoric acid has more to say in the question of productivity than any of these characteristics referred to, and can convert a barren waste, provided the necessary physical conditions are present, into an area of fair agricultural value.

General Remarks on the Warracknabeal, Minyip, and Murtoa Fields.

Looking through the average of the twelve fields must give satisfaction, for although the season, as is evident in the returns from the unmanured plots, was not so favorable as in the preceding year, the increases due to manures are much better. One fact in the general average standing out more pronounced than in the first experiments is *the much greater effectiveness of the easily soluble forms of the* phosphatic manures compared with the less soluble ; the returns from Thomas phosphate being less than half of the ordinary superphosphate, and those of bone-dust being so low as to work out at a loss. The conclusion of my report on the fields of the three districts might suitably end with a consideration of the profits resulting from the use of manures :—

Plot ...	1.	3.	4.	6.	7.
	s. d.	s. d.	s. d.	s. d.	s. d.
Value of increased yield due to *manures, at 2s. 6d. per bushel*	8 6	12 2½	13 2	13 5	5 7
Cost of manure	1 4	2 8	4 0	2 2	2 2
Profit due to manuring ...	7 2	9 6½	9 2	11 3	3 5

It is right to state that the manures given the last year differed very slightly in quantity from those of the preceding.

Criticism of Jeparit-Dimboola Results.

It was at Jeparit that tests were made three years ago with the small applications of manures which have since given such satisfactory results throughout the wheat-growing area of Victoria, and we have to thank Mr. Whitney, who first experimented on these lines in co-operation with this branch, for the unflagging interest in this subject he has since displayed. Interest in the matter has now become so general in the district that the manure demonstration field in this part of the State may be considered to have outlived its day. During the same year as Mr. Whitney conducted our first experiments at Jeparit there were also carried out at St. Arnaud by the three well-known farmers, Messrs. Telford, Mackay, and Scott, a number of manure tests on the same lines as those of Jeparit, and from the results obtained by this small group of men in the drier areas of Victoria there has been aroused by lectures and publications such an interest in the subject that an entire revolution has been brought about in some of the farming methods of a great part of the State.

In the tests of two years ago, carried out in the two districts of Jeparit and Dimboola, there were ten experimenters who handed in returns. Last year we received the results of four only. The results of the tests under review are, as it will be seen, confirmatory of those of the preceding year, with the exception that nitrogen appears to have produced a better effect than in the previous experiments, but it has not given the increased yields, taking the results of the general average as a basis for our remarks, sufficiently great to render its application a profitable one. The returns, however, of plot 10 on Mr. Whitney's farm deserve consideration. Comparing the average yields of the unmanured plots of last year in the Jeparit district with those of the preceding, it will be seen that they are considerably lower, reaching only 4·22 bushels per acre. In the case of the Dimboola soils, however, the case is reversed, the unmanured plots this year giving very much higher results than in the previous year. When we consider, however, the increase due to manures, we find that in both cases the figures are very much in favour of the last year. The same thing has been already noticed in other districts, and leads one to think that the season was such that without the manures so extensively applied last year on the wheat farms of the State the yields might have fallen to a lower level than they have done for many years. The profits due to manuring in the two districts, taking the general average, appear in the following tables :—

—	Plot 1.	Plot 3.	Plot 4.	Plot 6.
Value of increased yields at 3s. 3d. per bushel	11s. 2½d.	22s. 3¾d.	26s. 0d.	16s. 9d.
Cost of manure	1s. 4d.	2s. 8d.	4s. 0d.	2s. 2d.
Profit due to manuring	9s. 10½d.	19s. 7¾d.	22s. 0d.	14s. 7d.

HORSHAM DISTRICT.

Analysis of Results.

The returns from the experimental fields of this district are among the most satisfactory of the year's results. The average returns on plots 4 and 6 are striking, considering the low general average for the State and the unfavorable conditions of the season. The increases produced by the small quantities of manures used in plots 1, 3, 4, and 6 render prominent the profitable nature of their use, and indicate a strong hunger for, and an active response to, the phosphoric acid used in the application. The very small application in plot 1 seems to have produced exceptionally good results; and comparing the returns on plot 6, where 10 lbs. of phosphoric acid has been used in the form of an ordinary superphosphate, with plot 3, where 15 lbs. have been used in a more concentrated form, it appears that the lighter dressing has in three cases out of four produced as good or better results than the heavier quantity. Thomas phosphate, as revealed by the figures of the average, has only shown half the effective power of the superphosphate. An application of nitrogen, in the shape both of sulphate of ammonia and dried blood, has remained inoperative, and the figures of these plots seem to justify the opinion that the soils of the district are in no need of this ingredient.

From plot 13 to 27 there were a few special tests carried out in the district to determine questions outside the usual experiments of the ordinary experimental field. On plot 16 of Mr. Moegel's farm, the ordinary superphosphate was supposed to have been applied as a top dressing after the crop had come up. This operation had, of course, to be left to the farmer to carry out. It would appear, from the small increase on this plot compared with the much larger on plot 6, where the same kind and quantity of manure has been given, but with the drill, that the latter mode of application has resulted in much better results. On plot 18, however, where the sulphate of ammonia has been given as a top dressing six weeks after the crop had come up, a small benefit, comparing the returns of this plot with those of 10, appears to have followed the broadcast application. Lime on plot 19 appears to have resulted in a very slight increase. The unmanured plots on the Longerenong farm show such want of uniformity—owing, perhaps, to variations in the soil—that one must exercise caution in forming opinions that might appear deducible from certain figures in the tables. Taking plot 19, the application of lime alone appears to have produced a very appreciable increase, and it might be concluded that the soil of this farm, or perhaps the district generally, might be materially benefited by the application of lime. But this conclusion appears contradicted by the smaller increase on plot 13, where lime also has been applied, but in the form of gypsum, than on plot 3, where the same amount of superphosphate, but no gypsum, has been used. I have little doubt that on the stiff red clay patches lime or gypsum would show their effect, and it is possible that it was on such a type of soil in the field that the effect of lime has shown itself. To sum up, then, the farmers of the district might, until further tests,

which are certainly desirable, are made, confine themselves to the use of the phosphatic manures only, showing preference to a good ordinary superphosphate as being the most profitable. That the application of the superphosphate in the small quantities used in the experiments is a highly profitable operation appears in the following tables, calculated on the district average:—

	Plot 1.	Plot 3.	Plot 4.	Plot 6.
	s. d.	s. d.	s. d.	s. d.
Increased yield due to manuring, at 3s. 3d. per bushel ...	14 11½	19 6	20 0½	20 6
Cost per acre of manure ...	1 4	2 8	4 0	2 2
Profits due to manuring ...	13 7½	16 10	16 0½	18 4

Criticism of Results.—Stawell-Ararat.

The returns from the two fields indicate clearly the deficiency of the soils of the district in phosphoric acid. The increased yields where the superphosphates and Thomas phosphate have been used are very marked and of a highly profitable nature. As is the case over the greater part of the wheat-growing area, the superphosphate has proved much more effective than Thomas phosphate. The increase on plots 10 and 12 of Mr. Hutchins' farm would seem to show that both sulphate of ammonia and dried blood have had a strong operative effect. It is to be regretted that the returns from a number of other fields in the same district are not available to confirm these figures. It is so unusual for an application of nitrogen to show such marked effects that one feels disposed to regard the increase as more apparent than real, more especially as the unmanured plot adjoining has a considerably lower yield than any other of the plots without manure. The actual yield also on plot 12 is lower than on plot 6, where phosphoric acid only has been used. It is quite possible that the lower returns on plot 11 is due to some variation in the soil giving the appearance of a larger yield on the adjoining plots. In the field of Mr. Stewart, of Ballyrogan, nitrogen has apparently produced no effect. The returns on plots 10 and 12 falling below those on plot 6. The phosphatic manures have also acted splendidly on the soils of this farm, and, as in the case of Mr. Hutchins, it appears from the figures at present available that the medium dressing of only 51 lbs. of ordinary superphosphate to the acre may be a quantity sufficiently heavy for such soils as those experimented on. It is, however, advisable to have returns from a much larger number of fields before speaking too definitely on that point. The profits of the increased yields on the two plots work out as follows:—

	Plot 1.	Plot 3.	Plot 4.	Plot 6.	Plot 7.
	s. d.	s. d.	s. d.	s. d.	s. d.
Value of increased yield due to manure, at 3s. 3d. per bushel	12 5	23 3	23 0	23 9¾	17 7
Cost of manure	1 4	2 8	4 0	2 2	2 2
Profit due to manuring	11 1	20 7	19 0	21 7¾	15 5

THE LEONGATHA LABOUR COLONY AS AN EXPERIMENTAL FARM.

By F. J. Howell, Ph.D.

The interest in experimental field work in Victoria is of quite recent growth. Urged for years by those who knew its value, it seemed to the majority a matter deserving little serious attention, and to be regarded more in the light of one of the many fads put forward by men totally unaquainted with the practical side of agriculture. To-day the pendulum has swung to the other side, and the difficulty is to restrain applications for the establishment of costly institutions, which it is thought ought to be established in every district.

The Phrase Misunderstood.

The extent and full object of an experimental farm is not clearly understood in the country, and this, perhaps, is at the foundation of the many applications for the establishment of these farms on the one side and the objection to them on the other, which are now received daily by the Department. In some cases the idea of the farm seems to be confounded with that of our experimental and demonstration manure plots which have been distributed for the last two years throughout the country; in other cases the experimental farm seems to carry the meaning of a costly agricultural college, engaged more in the teaching of the principles of agriculture than in gathering new facts from a system of field experiment. Both conceptions, it need not be remarked, are wrong, and ought to be got rid of.

The Meaning of the Term.

An experimental farm is not a number of small plots covering, perhaps, two or three acres and conducted for a year only. It is not an agricultural college, where the teaching only of agriculture is carried on and no field experimenting; nor is it, in the European and American conception of the term, an experiment station, which, although not engaged in teaching agriculture, has, nevertheless, costly buildings and laboratories, and a number of highly-trained chemists, botanists, entomologists, &c., &c., who carry out investigational work, apart from field work, in their well-equipped laboratories. An experimental farm is neither of these. It differs from our experimental or demonstration plots in being 50 or 100 times larger, and including in its tests not a few trials with manures only, but a number of experiments in cultural operations, rotations, the growth of fodders, grasses, and economic plants, the improvement of all our cultivated crops, and a number of other investigations too extensive, too complicated, and demanding too much time and expert knowledge to be carried on by the farmers throughout the country, on the same lines as the experimental plots. It differs from the agricultural college in having no costly teaching staff to maintain. It differs from the experiment station in having its investigations confined almost exclusively to field experiment, and necessitating no expensive staff of scientists on the grounds to carry out laboratory

investigations. It is important that the meaning and the object of an experimental farm should be clearly understood, since it is such institutions that are now advocated for Victoria.

Are Experimental Farms Necessary.

All possible progress in practical agriculture must rest upon an experimental basis. This will be denied by no one. It is urged that instructors should be sent to the country. Until there are facts to convey, it is useless to think of sending instructors. The experimental farm is the breeding ground of such facts. Equipped with a body of facts, resulting from experiment, a travelling instructor may do an incalculable amount of good in a farming community by properly disseminating those facts; but to stand up and preach principles, or put forward results obtained under totally different conditions of soil and climate some thousands of miles away, is to create ridicule and court failure. To obtain the necessary facts we shall have to look, as all other civilized countries have done, to the experimental farm. As a proof of its necessity, we have, in particular, the example of the United States and America, while in a less degree there is scarcely a country depending upon its agricultural interests that has not recognised the fact, and made ample provision for carrying it out. That it is not a mere agitation, got up by a few ambitious officers in the Agricultural Department for their own benefit, is too evident, from the memory of the great conference at the last agricultural show. At that conference there were 68 agricultural societies sent delegates, who supported the resolution in favour of the establishment of experimental farms, and afterwards waited upon the Honorable the Minister, and urged the necessity of giving the matter immediate consideration. The wish then that such institutions should be established is the wish of the agricultural community, and deserves consideration.

Where are the Farms to be Located.

Both Mr. Pearson and myself, in our evidence before the Royal Commission on Technical Education, recognised the great climatic and soil variations of Victoria, and suggested that four such farms or stations might be established. For the northern areas, the grounds of the Dookie and Longerenong Colleges appeared to offer suitable sites, and it was thought that some permanent arrangement might be come to with the Council of Agricultural Education to initiate a system of field, stall, and irrigation experiment that would apply to the whole northern area. Longerenong, especially, seemed to me to offer an ideal position for the study and control of soil moisture, the working out of cultural operations adapted to dry districts, the introduction of drought-resisting grasses and fodder plants, and the study of problems having special reference to our great wheat-growing area. Circumstances, however, will perhaps give the first opportunity of commencing permanent experimental work in a portion of the State which by preference might have been left for the last position. It was suggested in the report referred to that the remaining stations should be, one in the Western District the other in Gippsland. The

indications are that our first opportunity for taking up the work might be in Gippsland.

The Labour Colony as an Experimental Farm.

There are arguments which will be used for and against the selection of Leongatha as the site for a Gippsland experimental farm. Claims may be put forward by districts more centrally situated and possessing soils of a superior nature, and perhaps representative of a larger area of Gippsland than the lands of the Labour colony. The main consideration is, however, one of climate, and in its rainfall and humidity Leongatha may be considered fairly typical of the main portion of Gippsland. That the greater portion of the soil is not of first-class quality is revealed both by inspection and chemical analysis, but this, although not allowing of the flattering returns which might be reported annually from the splendid soils of some parts of this portion of our State, will probably *help in the working out of methods for improving the immense* tracts of poorer land which perhaps constitutes the greater portion of Gippsland. Reference to the geological map will indicate the type of soil found in the Leongatha district. The greater portion of the cleared part of the farm is composed of the so-called buckshot soils inclined, it is reported, to excessive wet in winter, but showing the effects of dry weather very quickly in summer. The red soil shows two shades, the darker apparently being the superior. The flat land forms an appreciable area, but would require drainage. In fact, from report and appearances the necessity of drainage appears apparent over a great portion of the farm. A winter inspection, however, could only decide on this point. An analysis of the three classes of soil was carried out in this laboratory in the year 1895. From the figures below it will be seen that the land from the chemical point of view is only of inferior to medium agricultural value :—

—	Nitrogen.	Phosphoric Acid.	Potash.	Lime.	Chlorine.
Soil No. 1.—Fine sandy clay loam, dark-grey, fairly friable and permeable	203	52	58	172	5
Subsoil.—Similar to soil, but stiffer and lighter in colour	82	35	55	52	6
Soil No. 2.—Brownish-grey fine sandy clay loam, more friable and open than No. 1	103	72	82	4.5	4
Subsoil.—Brown fine sandy clay, with stones, stiffer and less open than the soil	54	51	104	132	7
Soil No. 3.—Light-grey sandy clay, more sand than No. 1, and a few stones	95	42	52	140	4
Subsoil.—Similar to subsoil No. 2, but a little stiffer	67	53	76	218	5
		Not less than—			Not more than—
It may be considered that a first-class soil should contain	250	150	200	400	35

The cuttings and drains disclose in places irregular layers of nodules (buckshot). The presence of these would interfere with the *rise of moisture from below to the surface of the soil, and most* probably is the main reason of crops in parts going off as reported during dry spells.

The Utility of an Experimental Farm in Gippsland.

Gippsland is essentially a dairying and grazing district, and the establishment of an experimental farm may be considered premature. *The Western District, with its much wider present field of agricultural* operations, might insist on priority of claim; for, unfortunately, the establishment of institutions of the present kind are looked at in all cases from the petty local selfish point of view, and with none of the national spirit that ought to rule in matters of this kind. It is assumed that a set of experiments, or a teaching institution, in one part of the State can result in no benefit to another part. As far as field experiments are concerned, there is every evidence that where fairly uniform climatic conditions prevail, the results of one district may have a very large application to immense outlying areas. No one denies the splendid effect of the Rothamstead experiments on the agriculture of the whole of Great Britain or, as far as that goes in a more restricted sense, on the agricultural procedure of the world. While in no way adhering to the views that the labour colony is the most suitable site either in Gippsland or the southern portion of the State, there is no doubt that the conversion of this property into an experimental farm would afford in time a mass of valuable facts applicable to the whole of the southern portion of the State. There is no reason why Gippsland alone should not some day support a population equal, perhaps, to that of Australia at present, but it will not be done by dairying and grazing alone. With its splendid rainfall, there are possibilities in the growth and variety of crops that can be looked for no where else in the State. It is time the attention of the people was drawn to this fact. It was the duty of an Agricultural department to experiment with the crops that might be raised, to find out the methods to be pursued, the cultural operations required, the manures demanded, the rotative courses to be followed, and the hundred and one other facts that ought to be placed in a farmer's hands before launching into a new undertaking. Such facts can only be obtained by years of patient, systematic experimenting. Taking two crops only—the beet and the flax—I feel disposed to think, from the few facts already to hand, that we have in the cultivation of these two crops alone, properly understood and conducted, the means of altering the whole face of Gippsland.

The Nature of the Experiments.

The nature of the experiments have already been partly referred to, and can only be indicated generally. These would be introduced gradually, and might finally include :—

Manuring experiments on various crops over a number of years.
Methods of cultivation.

Rotative cropping.
Experiments with grasses and fodder crops.
The introduction of new agricultural crops.
The improvement in the quality of crops through cultural and manurial operations.
The improvement of crops through seed selection, &c.
The better utilization of native plants.
The improvement of pasture lands through manurial treatment and more rational mixtures.
Experiments in the eradication of weeds.
Investigations in the suppression of insect pests.
Experiments in various questions concerning live stock, &c., &c.

The Annual Cost of the Farm.

The cost of working an experimental farm must not be gauged from the point of view of the expenditure incurred in the working of an ordinary farm. The numberless plots of small area, the precise and accurate methods of working, the separate sowings and harvestings, the careful weighings in each case, and the constant care and attention, are altogether different from the wholesale nature of the operations on an ordinary farm, and entail an amount of extra labour only recognised by those who have had experience in the matter. The following estimate of the first year's expenditure for carrying on the necessary operations at the farm will, perhaps, be found to be under rather than over estimated, that is, assuming the experiments to cover anything like the variety of ground indicated by the general sketch of experiments above :—

1. Superintendent as farm manager ...	£150	0	0	to	£200	0	0
Foreman of labour	120	0	0	"	120	0	0
Three farm operators, at 6s. per day	280	16	0	"	280	16	0
One boy	52	0	0	"	52	0	0
Additional labour at busy periods ...	120	0	0	"	120	0	0
Manures and pegs	200	0	0	"	200	0	0
Seed	50	0	0	"	50	0	0
Contingencies	50	0	0	"	50	0	0
	£1,022	16	0		£1,072	16	0

For the necessary implements, machinery, stock and feed for commencing operations an additional £500 at least would be required for the first year.

An Experimental Farm not a Paying Farm.

It must be recognised from the first that an experimental farm cannot be expected to be a paying concern. Immediately such a thing takes place the farm loses its experimental nature and becomes useless to the farmer as an investigating medium. The work of an experimental farm is the attempted discovery of new facts that might be supposed to assist in the progress of agricultural practice. In the

discovery of one such fact there might be a hundred failures, but the value of such a fact might be of more worth to a country by a thousand times than the cost of the failures that preceded it. It is in this light that the farmer, and the public generally, must regard this new departure in agricultural education. Free from the captious, carping criticism of persons who do not recognise the true nature of such work, and removed from the noisy impatience for immediate results which so hamper the efforts of men engaged in experimenting, there is little doubt that such an institution as at present proposed will do as much for the advancement of agriculture in Victoria as similar institutions have already done in other parts of the world.

DAIRYING BRANCH.

FODDER FOR THE DAIRY HERD.

By T. Cherry, M.D., M.S.

The unfavorable outlook for the approaching winter as far as the natural pasture grasses are concerned is turning the attention of every thoughtful farmer to the question of providing fodder for his cattle. Papers in earlier numbers of this journal have already dealt with two of the most important fodder plants. Our present object is to give a general view of the problem of foods and feeding, and to see what provision can be made during the present winter by planting crops which will be available for the coming summer. When pastures furnish an abundance and variety of grasses no better food can be found for the milch cow. But before ripening mixed grasses contain from 65 to 80 per cent. of water, and a cow requires at least 100 lbs. of such material in the course of a day if she is to yield a profitable quantity of milk. This amount represents two cornsacksful, pressed down pretty firmly. As the grass dries it loses a great deal of its water, so that the same amount of nutriment may be obtained from much less weight, but by the end of summer the seeds have blown out, and much of the soluble material has disappeared, so that the grass, however plentiful, becomes dry, indigestible, and nearly useless for food. The cow finds it hard enough to obtain sufficient nourishment to keep up her own weight, without having any surplus to spare from which she can manufacture milk.

For it must be remembered that the animal body is like a machine in this respect, that is able only to transform the food materials into other forms of energy or into different chemical substances. It is no more able to create within itself the power of doing work or of secreting milk than a steam-engine can keep on running when not supplied with wood and water. The food of the steam-engine consists simply of carbon and water. That of the animal is more complicated. Water and carbon it must have in abundance, but the carbon is useless for the purposes of life in the form of charcoal. It requires to have been first of all worked up by plants into the form of starch and sugar, or of oils and fats. But the animal differs totally from the steam-engine in this respect. Not only must it have the foods already mentioned, but others still more costly and complicated must be provided. This class of foods is called *protein* or *albumin*, and is found to consist of not only carbon and water, but also of nitrogen and traces of phosphorus and sulphur.

Chemical Composition of Foods.

Wherever life of any kind exists, whether it be in the form of plants or animals the above classes of chemical substances are always found. However different a plant may be from an animal the difference is due to the varying distribution of these materials, rather than to the

presence of any distinctive substance in either plant or animal. Speaking roughly, plants are distinguished by the preponderance of carbon, animals by the relative amount of protein.

Carbon forms the charcoal of the plant. It exists in the form of wood and fibrous materials, as starch and sugar (carbohydrates), and as oils and fats. Wood and fibre is generally too tough for the animal to digest and utilize as food, but the carbohydrates and fats form most important articles of food. They serve as fuel for the body, keeping up its warmth, and supplying it with much of the material for doing work. In the case of the cow they furnish a large part of the solids of the milk. For these purposes any given quantity of fat has a food value of *two and a quarter times the same weight of carbohydrate.* This fact explains the instinctive liking that all animals have for fatty foods in cold weather. The sugars, starch, and oils are found most abundantly in seeds and fruit, but reference to the table which follows shows that they are present in all parts of the plant.

Protein consists not only of carbon and water, but also contains nitrogen, and traces of phosphorus, sulphur, potash, and many of the inorganic salts. *Its distinctive feature is the nitrogen which it contains.* Protein is the essential part of all living substances, and it is for its replenishment that nitrates, ammonia, sulphates, and phosphates are required in manures. Nitrogen exists in nature chiefly in the form of the gas which constitutes four-fifths of the atmosphere. But with some few but very important exceptions, plants are not able to make use of it in this form. They require to have it presented to their rootlets in such form as nitrates or ammonia salts dissolved in the water of the soil. The plant stores the nitrogen chiefly in the seed, and thus in the form of protein it becomes available as food for animals. The white of egg, lean meat, and the casein of the milk are examples of nearly pure protein. Blood, muscles, nerves, and organs not only consist largely of protein, but they require this same substance, or others very like it, as food to make good the wear and tear of daily life, and to provide for growth and development. Hence protein is an essential part of the food of all animals. The plant, under the influence of the heat of the sun, slowly and laboriously manufactures it from the soil; animals eagerly appropriate it from the plant or else from one another, so that the struggle for existence has been well described as "the struggle for nitrogen." *Every moment the living parts of our bodies are being worn out and renewed, and this renewal can only be effected by protein in the food.* Protein is therefore an essential part of every ration, and from what has been said it will be seen that it is the scarcest and most costly part of every ration.

But while the chemical composition of the food is thus fixed there is another point of supreme importance. The food must not only have the right constituents, *but it must also be digestible and palatable.* The mere taking of food into the stomach is not sufficient to sustain life. The juices secreted by the walls of that organ must act on it, and reduce it to such a condition that the solid parts become dissolved and are thus able to permeate the walls of the stomach and intestines and enter the blood. By the blood they are carried to all parts of the bod

to supply the food required by the working parts. The food must therefore contain a proper proportion of digestible matter. When the stomach is filled with a mass of dry, hard, innutritious grass, leaves and straw, not only is the animal deprived of proper nutriment but it cannot make use of the digestible parts of that which is actually present in the stomach.

Then also the food must be varied in character and appetising. We all know the effect upon ourselves of the way in which a meal is cooked and served, and the same holds good for all animals. The sight and smell of food, and the anticipated enjoyment of the meal are the chief stimulants to the secretion of the gastric juice. It has been shown by recent experiments that suitable food may be placed in the stomach of a starving animal, and no attempt will be made to digest it if the animal is not aware of its presence. In the same way the digestive juices will be secreted in abundance if the animal merely *thinks* he has swallowed food. He may be completely deceived on this point, but preparations for the digestion of the meal are made all the same. Hence successful feeding implies variety as well as quantity and quality.

Relative Value of Food Stuffs.

A knowledge of the chemical composition of any food is not of itself sufficient to enable us to estimate its value to the animal. We require to know in addition how much of each "nutrient"—the name given to the nutritive parts of the food, including protein, fat, carbohydrates, and mineral matters—is digestible or available for the purposes of the animal economy. The following table has been copied from Bulletin 132 of the Agricultural Experiment Station of the University of California; and the requisite analyses have been carried out, partly at the laboratory of that University and are partly derived from Henry on "Foods and Feeding." The climatic conditions make the results obtained in California more directly applicable to Victoria than those derived from Europe or the Eastern States of America. The *nutritive ratio* gives the proportion which the protein bears to the weight of the carbohydrates and fats combined, 1 lb. of fat being calculated as equivalent to 2·25 lbs. of sugar, starch, or gum. For instance, let us take green lucerne. Taking the figures from the table the nutritive ratio is calculated as follows:—

Percentage of carbohydrates	7·30
Add food value of fats, ·6 × 2·5 ...	= 1·50
Total	8·80

Divide 8·80 by the percentage of protein, viz., 3·7 and the quotient is 2·37, thus—

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3·7) 8·80 (2·37
     7·4
     ----
     1·40
     1·11
     ----
      290
      259
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And the decimal may be carried to any desired degree of accuracy. Hence the nutritive ratio of green lucerne is said to be 2·3, that is, it contains one part of digestible protein to about two and a third parts of all the available non-nitrogenous constituents. This is an example of a "narrow" ration, because the nitrogen is large in proportion to the total of all the digestible nutrients. On the other hand, potatoes are an example of a "wide" ration, because the protein is small in proportion to the other nutrients (1 to 18·4).

DRY MATTER AND DIGESTIBLE NUTRIENTS IN 100 LBS.

Feed Stuffs.	Dry Matter in 100 lbs.	Digestible Nutrients in 100 lbs.			Nutritive Ratio.
		Protein.	Carbo-hydrates.	Fat.	
Green Fodder.					
Lucerne ...	20·0	3·7	7·3	·6	1 : 2·3
Saltbush ...	23·5	2·5	9·2	·3	1 : 3·9
Barley ...	21·0	1·9	10·2	·4	1 : 5·8
Red Clover	29·2	2·9	14·8	·7	1 : 5·6
Maize ...	20·7	1·0	11·6	·4	1 : 12·5
Cow Pea ...	16·4	1·8	8·7	·2	1 : 5·1
Horse Bean	15·8	2·2	7·1	·2	1 : 3·5
Oats ...	37·8	2·6	18·9	1·0	1 : 8·1
Orchard Grass	27·0	1·5	11·4	·5	1 : 8·3
Rye ...	23·4	2·1	14·1	·4	1 : 7·1
Soya Bean	24·9	3·2	11·0	·5	1 : 3·8
Sorghum	20·6	·6	12·2	·4	1 : 21·8
Silage.					
Barley ...	26·0	1·8	12·7	·9	1 : 11·7
Clover ..	28·0	2·0	13·6	1·0	1 : 7·9
Maize ...	24·6	1·3	13·5	·6	1 : 11·5
Oat ...	28·0	1·5	14·8	·9	1 ; 11·3
Orchard Grass	23·0	1·1	10·6	1·0	1 : 11·1
Roots, &c.					
Beet, sugar	15·7	1·6	11·9	·1	1 : 7·6
Cabbage ...	15·3	1·8	8·2	·4	1 : 5·1
Carrots ...	11·4	·8	7·8	·2	1 : 10·4
Mangels ...	9·1	1·1	5·4	·1	1 : 5·1
Parsnips ...	11·7	1·6	11·2	·2	1 : 7·3
Potatoes ...	21·1	·9	16·3	·1	1 : 18 4
Pumpkins	9·1	1·0	5 8	·3	1 : 6·6
Turnips ...	9·5	1·0	7·2	·2	1 : 7·7
Hay.					
Lucerne ...	89·1	12·3	37·1	1·6	1 : 3·3
Barley ...	91·5	5·8	43·1	1·6	1 : 8·1
Clover, red	84 7	6·8	35·8	1·7	1 : 5·8
Cow Pea ...	89 3	10·8	38·6	1·1	1 : 4·7
Oat ...	89·9	4·5	43·7	1·5	1 : 10·5
Rye Grass	86·0	6·1	37·8	1·2	1 : 6·6
Vetch ...	88·7	12·9	37·5	1·4	1 : 3·2
Wheat ...	91·2	3·6	46·1	1·1	1 : 13·2

DRY MATTER AND DIGESTIBLE NUTRIENTS IN 100 LBS.—*continued.*

Feed Stuffs.	Dry Matter in 100 lbs.	Digestible Nutrients in 100 lbs.			Nutritive Ratio.
		Protein.	Carbo-hydrates.	Fat.	
Straw.					
Barley	85·8	·7	41·2	·6	1 : 60·8
Oat	90·8	1·2	38·6	·8	1 : 33·6
Soya Bean	89·6	2·3	40·0	1·1	1 : 18·4
Wheat	90·4	·4	36·3	·4	1 : 93·0
Grain and Seeds.					
Barley	90·0	9·6	63·5	2·1	1 : 7·1
Maize	89·4	7·8	66·7	4·3	1 : 9·8
Cow Pea	85·2	18·3	54·2	1·1	1 : 3·1
Oats	89·0	9·2	47·3	4·2	1 : 6·2
Rice	87·7	5·3	67·6	·3	1 : 11·8
Soya Bean	89·2	29·6	22·3	14·4	1 : 2·0
Sunflower	92·5	12·1	20·8	29·0	1 : 7·1
Wheat, old	91·7	13·7	47·6	1·4	1 : 3·7
Products.					
Brewers' Grains (wet) ...	24·3	3·9	9·3	1·4	1 : 3·2
Cocoanut Oil Cake ...	85·9	16·4	42·4	9·7	1 : 3·9
Maize Meal	88·0	6·4	66·3	3·4	1 : 11·5
Linseed Meal	89·1	26·1	38·5	6·5	1 : 2·0
Pea Meal	89·5	16·8	51·8	·7	1 : 3·2
Peanut Meal	89·3	42·9	22·8	6·9	1 : 0·9
Wheat Bran	88·3	11·2	42·2	2·5	1 : 4·3
Pollard	88·3	12·2	53·4	3·8	1 : 5·1

The foregoing table should be kept for reference, as it gives the relative nutritive values of most of the foodstuffs commonly used in this State. Various rules have been adopted for calculating the commercial value of any given material. None of these are quite satisfactory, but a fair comparison may usually be made by reckoning the protein as worth twice as much as the carbohydrates, and the fats as worth from two and a half to three times the carbohydrates. Take the following examples from the table :—

OATS.

Protein—9·2 × 2	=	18·4
Carbohydrates	=	47·3
Fats—4·2 × 3	=	12·6
Total		78·3

BRAN.

Protein—11·2 × 2	=	22·4
Carbohydrates	=	42·2
Fats—2·5 × 3	=	7·5
Total		72·1

Hence, 72 lbs. of oats are worth as much money as 78 lbs. of bran. In other words, allowing for the difference in weight of the respective bushels, when bran is at 1s. oats are worth 2s. 2d. the bushel. As a

matter of fact, the market value of oats is always somewhat higher on account of their special value as horse-feed.

VALUE OF PROTEIN.

The value of protein as the necessary food for keeping up all the living tissues of an animal has been already explained. The most difficult problem of both feeding cattle and raising crops is to keep up the supply of this all-essential nitrogenous food. It will be seen that of green fodders the various legumes, as lucerne, clovers, peas, and beans stand pre-eminent, while the large amount which saltbush contains explains at once the high value of this as a forage plant. All the root crops are relatively poor in protein, while ensilage and hay correspond to the greenstuff from which they are made, but in hay the percentage is relatively high, because the dry matter has been increased by the disappearance of 60 per cent. of the water. As the crop ripens the protein is rapidly concentrated in the seeds, and hence the richness of grain and the poverty of straw. Here again the quantity of protein attains a maximum in peas and beans. The high food value of the various by-products is explained by a glance at the table.

The quality and quantity of food supplied to our dairy cattle has, up to the present, been left too much to chance. When the seasons are favorable no better food can be found than the natural pasture grasses, but these require to be regularly supplemented. No fact has been more clearly demonstrated than that the yield of milk and butter fat are dependent on the food supply. This, of course, is what one would expect, since the first use of the food is to keep the animal alive, and it is only the surplus of the ration that the cow can turn into milk. Taking 1,000 lbs. as the standard weight of a cow, it is found that to maintain the full milking capacity the following average ration is required :—

Dry matter in food		... ...	25 lbs.
Containing	Digestible	Protein ...	2·5 lbs.
,,	,,	Carbohydrates	12·5 lbs.
,,	,,	Fats... ...	·5 lbs.

together with at least 75 lbs. (7½ gallons) of water and a little salt. In hot weather the water requires to be greatly increased. The amount of dry matter in the form of coarse fodder should be about 16 lbs., and the quantities should be so adjusted that the nutritive ration is 1 : 6·5. In other words, cows do not yield their best if fed on too coarse or too concentrated foods. If we turn to the table it will be seen that all the above requirements are contained in about 80 lbs. of fresh red clover, or in 100 lbs. of good rich mixed pasture grasses. To supply the difference between the above standard quantities and the amount that the cows actually obtain is the problem which has to be faced by the dairying industry in Victoria. The solution of the problem is all the more urgent by reason of the non-appearance of the autumn rains.

FEEDING RATIONS.

Let us see how the full ration may be supplied, supposing the cows are wholly hand-fed, and always keeping in mind the fact that variety of food and a palatable mixture are essential.

Lbs.	Dry Matter.	Protein.	Carbo-hydrates.	Fats.
		I.		
10 Lucerne Hay	8·9	1·23	3·7	·16
10 Oat Straw	9·8	·12	3·8	·08
20 Mangels	1·8	·22	1·1	·02
4 Oats	3·5	·37	1·8	·17
4 Bran	3·5	·45	1·7	·10
	27·5	2·39	12·1	·53
		II.		
12 Lucerne Hay	10·68	1·48	4·46	·18
40 Maize Silage	10·00	·50	5·39	·22
4 Bran	3·53	·45	1·69	·10
	24·21	2·43	11·54	·50
		III.		
25 Lucerne	5·00	·74	1·4	·12
14 Oaten Hay	12·80	·65	6·2	·21
20 Maize Silage	5·00	·25	2·7	·11
4 Bran	3·53	·45	1·7	·10
	26·13	2·09	12·0	·54
		IV.		
40 Mangels	3·6	·44	2·2	·02
18 Oat Hay	16·2	·80	7·8	·26
3 Linseed Cake	2·6	·78	1·1	·20
3 Bran	2·6	·34	1·2	·08
	25·0	2·36	12·3	·56

It will be seen that in all cases the difficulty is to provide the requisite amount of protein without unduly increasing the bulk of the ration and the amount of carbohydrates. Hence the use of bran and other concentrated foods, and even with these additions Rations I. and III. are both rather bulky and the latter contains decidedly too little protein.

CONCLUSION.

In order to see how the food each cow is receiving actually compares with the amount given in these rations, the food should be carefully weighed. The nutritive value of each kind may then be calculated from the table, and tabulated in the form of the preceding rations. The question should then be asked—Is the cow picking up enough grass in the paddocks to make up the deficiency? If not, the ration should be brought up to the standard, and the increase in the milk noted. The point where judgment is necessary is in valuing the food that the animal obtains while grazing. The appetite of the cow is usually a pretty safe guide as to when she has not had enough.

As to providing for next season's fodder, the thing which should be done at once is to put in a crop of oats for hay. Later on a small area (irrigated if possible) for mangels and maize should form a part of every dairy farm, and the supreme importance of lucerne as the chief of fodders is amply borne out by the results of scientific feeding as well as by the experience of 40 years.

MILKING SHEDS.

By R. Crowe.

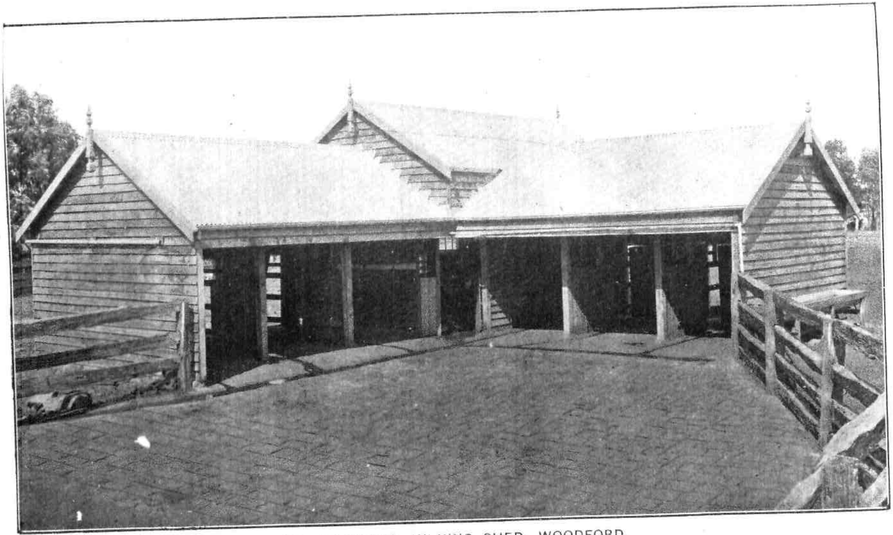
The type of milking shed at present in use throughout the Western District of Victoria is the result of much experience and study. Dairy farmers who keep from 50 to 150 milch cows have to consider the saving of time and labour, so that their work will be profitable and attractive.

Not so long ago the arrangements for milking on the majority of farms were very crude. The cows were driven into a yard which, in wet weather, was anything but inviting. The bails were often found situated in the open, unprotected from the weather, and where the cow stood to be milked there was usually neither floor nor system of drainage, so its condition can be better imagined than described.

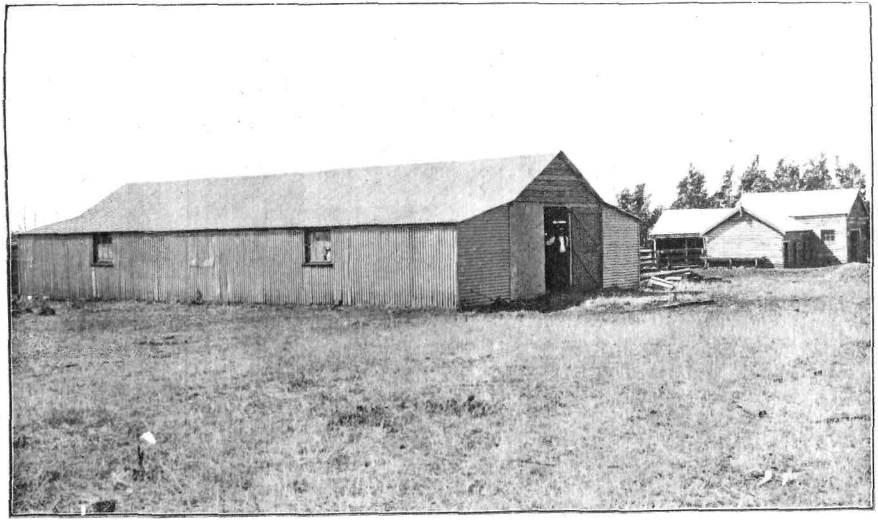
No wonder that families brought up to dairying under such environments should rebel against rural life, and yearn for the lot of those in the cities and towns. The want of conveniences on dairy farms in the early days caused many a promising lad to clear out from his parents and take to a vagabond life. It may be said, however, that in very many cases there was no help for it, as only a commencement was being made.

Dairying prior to the adoption of the factory system was uncertain, and circumscribed means frequently precluded the provision of the necessary facilities. Within the last few years a great change has taken place, and the industry has become recognised as a paying and permanent one. The advisability of providing essential requirements is no longer doubted, and as indicated previously many models of convenience and comfort in the shape of milking yards and sheds are now to be found. The accompanying illustration is typical of a great number of Victorian milking sheds: half of it containing three bails is facing towards the north, whilst the other half runs at right angles, and has an eastern aspect, thus allowing any amount of sunlight to beam directly on the spot where the cows stand when being milked. The back of the shed is therefore in the direction of the prevailing rough weather, south-west. At the angle of the building there is a waggonette and wash-up shed, as well as conveniencies for cooling milk and heating water. The door at the corner leads directly on to a platform on a level with the bottom or floor of the waggonette, which is, under ordinary circumstances, loaded with the empty factory milk cans, prior to the cows coming in.

As the cows are milked the quantity given by each is weighed and recorded, and strained directly into the milk cans. From time to time a sample of each cow's milk is taken and tested. By keeping an account showing the amount of milk and its butter fat value it can always be ascertained to a nicety what profit each individual member of a herd contributes. When the weather is warm the cans are partly submerged in a vat of cold water and left there till the last cow is milked, they are then placed in the waggonette and driven to the creamery immediately. When the skim milk is brought back it is emptied into a tank provided for the purpose of calf and pig feeding.

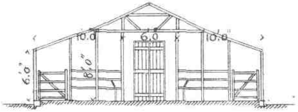


MR. JACKMAN'S MILKING SHED, WOODFORD.

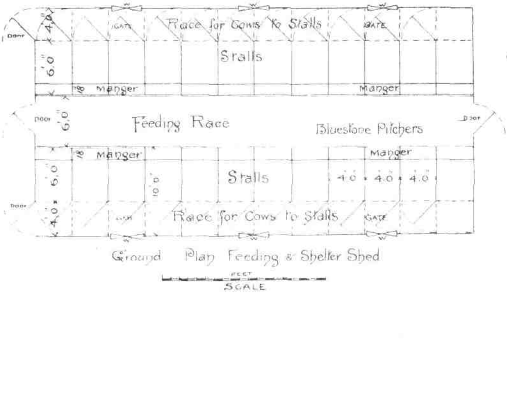


MR. JACKMAN'S SHELTER AND FEEDING SHED.

PLAN OF MILKING FEEDING, AND SHELTER SHED.

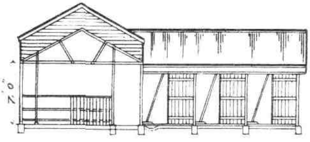


Section

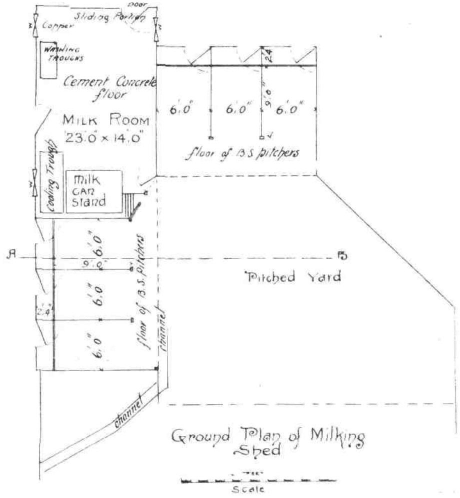


Ground Plan Feeding & Shelter Shed

SCALE

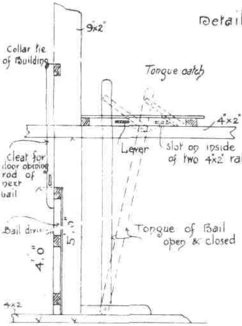


Section on line A B.

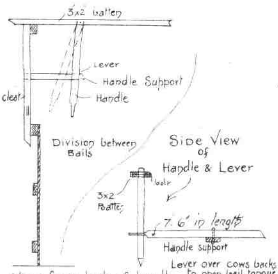


Ground Plan of Milking Shed

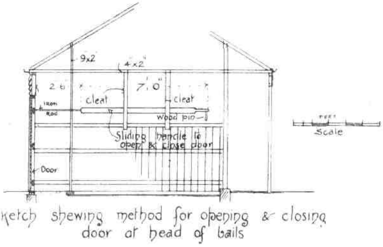
Details



Sketch shewing manipulation of Tongue of Bail



View from back of handle & lever to manipulate tongue catch of Bail



Sketch shewing method for opening & closing door at head of bails

The yards have by this time been cleaned and swept, and steam and hot water are ready to wash and scald the milk cans in that portion of the building set apart for the purpose. However, it is in the matter of paving that the modern yards excel. Where procurable, bluestone pitchers (cubes of 9 inches) are used, these are firmly bedded on sand with a fall for drainage of 1 inch in 2 feet. The top surface is rough-axed and the grouting is done with cement. Two yards are provided, the outer or large yard capable of accommodating all the cows to be milked, and the small or inner yard into which drafts of twenty or so are driven at a time, in order to be convenient for bailing up.

Immediately each cow is milked she is allowed to pass through a doorway at the head of the bail into another yard, or into the grazing paddock. The contrivances used for opening and closing the tongues of the bails and doors in front of the cows are of various kinds—all being more or less ingenious. The drawings accompanying the photograph of Mr. Jackman's shed fully illustrate the method adopted by him. By the side motion of a lever at the back of the cow the bail is closed or opened. The push or pull of another lever opens or closes the door in front. With the adoption of simple wooden levers there is nothing to break or get out of order as with cords and pulleys. This form of yard and shed enables a number of cows to be milked expeditiously with least knocking about of the cattle, and with a minimum amount of trouble to those engaged in milking.

Shelter and Feed.

Our system of dairying, coupled with our favorable climate, seems to demand a different method of managing dairy stock to that practised in countries with more rigorous weather conditions. Quite a number of old world byres have been tried, the feeding, housing, and milking of the cattle being carried on in the one building. After a time this practice was discarded in favour of separate structures; the one for milking and the other for feeding and shelter. This method is more conducive to a pure clean milk supply than that in which the milking operations are carried on in the presence of dust, an impure atmosphere, and the smell of fodder and bedding.

A photograph and plan are given of the shelter and feeding shed belonging to Mr. Jackman, Woodford.

THE TITRATION TEST IN CHEDDAR CHEESE MAKING.

By R. T. Archer, Dairy Supervisor.

Some years ago the late Mr. David Wilson, in reply to an inquiry for a method of testing acidity of milk or whey in cheese making, stated that no means of correctly estimating it was known. Since then much has been done in the investigation of the scientific problems involved in the manufacture of cheese, one result being the introduction of the titration test by which the acidity of milk or whey may be correctly estimated. The especial value of this in cheese making is apparent, since the acidity of milk may be gauged as soon as received at the factory, so furnishing a guide as to the best method of procedure. We can tell by its means whether the milk is sufficiently ripe or over-ripe, or whether it will require a starter, and if the latter, how much. It will also serve to indicate the strength of the rennet, if you have to use one to which you are not accustomed.

How to Make the Test.

The titration test is based on the fact that 1 c.c. (1 cubic centimetre) of a decinormal solution of caustic soda will neutralize ·009 gramme of lactic acid.

Put 20 c.c. of the milk or whey to be tested in a cup, and to it add five drops of phenolphthalein solution (2 per cent. solution in alcohol) for an indicator. Fill a graded burette to O with the caustic soda solution, and from the tap of the burette gently run the solution into the milk, stirring with a glass rod all the time. It will be seen that the solution will turn pink immediately it reaches the milk, but the colour will disappear on stirring. As more of the solution is being continually added the colour will take longer to disappear, until at length it ceases to do so, and becomes permanent. As soon as the permanent pink colouration is obtained stop adding the soda solution, and note how much has been used; say, 5 c.c.—then

$$\frac{5\text{ c.c.} \times {\cdot}009 \times 100}{20\text{ c.c.}} = {\cdot}225 = \text{the percentage of lactic acid present.}$$

A quick way of calculating is to multiply the number of c.c.'s of soda solution by 9, and divide by one-tenth of the c.c.'s of milk taken (that is 2 if 20 c.c., and 3 if 30 c.c., and so on), finally placing a decimal point in front of the result, thus:—

$$\frac{5 \times 9}{2} = {\cdot}225 \text{ per cent.}$$

The Test in Practical Work.

It will be found that mixed milk showing by the test ·17 per cent. of lactic acid will be very much too sweet to set, and without the aid of a starter will need to stand a good while before the acidity has developed sufficiently for renneting or setting. If the test should show ·19 to ·22 per cent, then the milk must be set. Should there be present ·25 per cent. the milk will be very quick running, and must be treated accordingly.

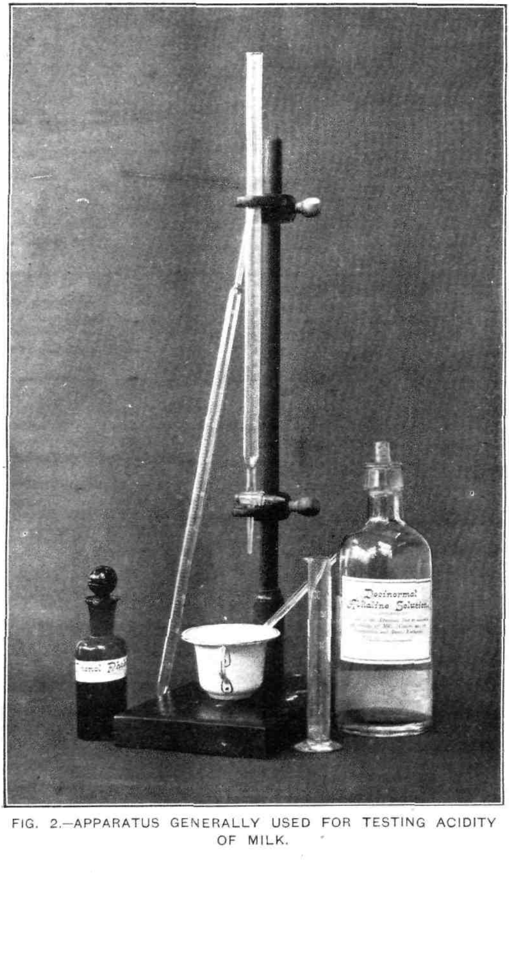


FIG. 2.—APPARATUS GENERALLY USED FOR TESTING ACIDITY OF MILK.

If the whey be tested when the coagulum is ready to cut it will be found that the percentage of acidity is considerably less than that in the milk when set, probably about two-thirds; thus, if the milk tested ·21 per cent. then the whey will test about ·14 per cent. This is due to some action of the rennet.

The acidity of the whey as shown by the test gives a guide to the condition of the curd, and indicates when the whey should be run off. Thus ·18 per cent. to ·22 per cent. of lactic acid in the whey will be found to correspond with the hot iron test drawing threads from $\frac{1}{8}$ to $\frac{1}{2}$ inch, and when the curd is ready to mill ·4 per cent. to ·7 per cent. of lactic acid will be equivalent to the hot iron test drawing threads from $\frac{1}{2}$ to 1 inch. The liquid caught from the press after draining for 10 or 15 minutes will test ·7 to ·9 per cent. if everything has gone right. Should it test more than 1·0 per cent. a quick maturing cheese will result, which must be sold and consumed the sooner.

Hints on Working.

These acidities will vary at the different stages according to the methods of working. For instance, one maker may prefer to set a little sweeter than another, or sometimes very much more acid is developed in the whey before running off, but these variations can be determined by the acidity test, and a standard fixed so as to enable a more uniform article to be made.

One of the most frequent errors of inexperienced cheese makers is that of setting the milk too sweet, but the use of the test furnishes a means of avoiding this. By waiting a few minutes for the development of a sufficiency of acidity in the milk, many hours may be saved later in the day. In tainted milk the presence of a good proportion of lactic acid is of special value, as the germs causing the taint are overpowered, and a fair if not good cheese will result. A good starter is required here, since the common taint germ tends to check the production of acidity. Sometimes when this taint germ is present the acidity of the drainings from the press will be less than that from the cooler, so that in such cases it is advisable to develop more acid than usual before hooping.

The Testing Apparatus.

The following is a list of the required apparatus, which may be procured from any wholesale chemist:—

	s.	d.
25 c.c. graded burette, with glass tap	4	6
Wooden burette stand	3	6
20 c.c. graded pipette cup	2	0
Glass stirring rod	0	3
1 oz. 2 per cent. solution in alcohol of phenolphthalein	1	0
Drop bottle	0	9
Winchester quart of decinormal solution of caustic soda	1	0
6-oz. stoppered bottle, for portion of soda solution ...	1	0
	14	0

The solutions should not be exposed to the air more than is absolutely necessary, as their strength is affected by exposure. An apparatus has been constructed to guard against this (Fig. 1). The caustic soda solution is contained in a Winchester quart bottle placed on a shelf above the rest of the apparatus. From this, by means of a glass syphon tube, the solution is conveyed to the burette. As this solution if exposed to the air deteriorates by absorbing carbonic acid gas, it must be kept in an air-tight bottle. But unless the air can enter the bottle none of the solution will syphon over. To overcome the difficulty, the air drawn into the bottle is made to pass through a small bottle of strong soda solution tinted with phenolphthalein. The carbonic acid in the air is absorbed by the soda in the small wash bottle before it passes into the large bottle of soda solution. The moment the solution in the wash bottle loses its power of absorbing carbonic acid it also loses its colour. This arrangement is found to work admirably, and the strength of the soda solution remains unaltered till used up.

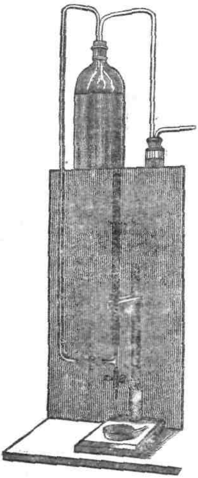
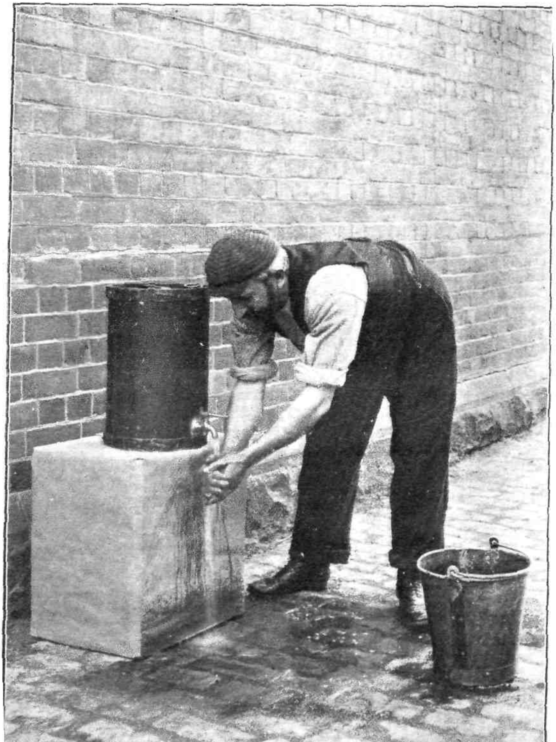


Fig. 1.—Lloyd's Apparatus for testing Acidity of Milk.

The syphon tube conveying the soda solution is attached to the bottom of the burette by a ⊣ joint, and the flow of solution stopped by a pinch-cock acting on a piece of indiarubber tubing which connects the syphon and ⊣ joints. Upon opening the pinch-cock the standard solution flows into the burette and carries up the float. When the line on this float corresponds with the first mark on the burette the pinch-cock is released, as the burette is now full.

An apparatus generally used in testing is shown in Fig. 2.

At the last conference of the Australasian Butter and Cheese Factories Managers' Association, Mr. Johnson gave a very simple and cheap test for the strength of the decinormal solution, consisting of a small glass tube hermetically sealed, containing 315 millegrammes of oxalic acid. This is sufficient to neutralize 50 c.c. of the soda solution. Should it take more or less than 50 c.c. the strength will be found by a simple rule-of-three sum, and corrected by adding more caustic soda or more distilled water.



HAND WASHING AT TAP.

CLEANLINESS DURING MILKING OPERATIONS.

By P. J. Carroll, Dairy Supervisor.

Milkers should wash their hands in clean water frequently during milking operations. A good plan for securing clean water every time was introduced by Mr. P. Fogarty, Cowwarr (*see illustration*), which I will explain for the benefit of the milkers. Procure a 5-gallon oil drum fitted with a tap, place in a convenient position in the cow yard, preferably close to the milk stand, and fill it with clean water. After the milker empties his pail, he goes to the water can, turns the tap and washes his hands. The advantage of this system over the use of a bucket or basin is that you get clean water every time, otherwise a number of milkers are likely to wash their hands in the same vessel, and the object aimed at is defeated. When a bucket is used the water soon becomes highly impregnated with filth organisms, and possibly the germs of disease from some cow that may be suffering from sore teats, and may serve as a medium for inoculating disease to the whole of the herd, causing no end of trouble and annoyance afterwards. There is also a consequent loss of milk, as, in the process of milking, the nerves of the teat are acted upon and stimulated to induce milk secretion; but the pain caused by sore teats suspends it almost entirely.

The practice of dipping the hands in the milk to moisten the teats is a disgusting habit, and milking with dry hands is much preferable.

VITICULTURAL BRANCH.

SEASONABLE WORK IN THE CELLAR AND VINEYARD.

By R. Dubois, B.Sc.

JUNE.

CELLAR.

South of the Dividing Range.—The first racking of the new wines should be proceeded with early this month. The object of this operation is to separate it from the thick lees, which are injurious to the future keeping qualities of the wine.

North of the Dividing Range.—The first racking of strong full-bodied wines is completed by the beginning of the month. Light wines may wait until the end of June. Fill up casks containing old wines once every fortnight.

VINEYARD.

Pruning is started this month when the vine has shed all its leaves. Start on varieties which shed their leaves first (Muscats, Gordo Blanco, Mataro, Gouais). Some vignerons begin pruning early in May, when the vine is still covered with green leaves. This practice should be discarded, as it is injurious to future crops, the wood not being completely ripe as long as leaves remain on the plant. Too early pruning has the same injurious effect as allowing animals to strip the leaves off after vintage.

In districts liable to spring frosts, prune as late as possible.

Continue layering where required, and start digging, being careful to form a basin around each vine, or a small trench along each row, when trellised.

"The object of digging is to completely cultivate round the vine, to destroy weeds which the plough cannot reach, and kill the larvæ or eggs of insects found under the old bark near the collar of the plant. It also helps to destroy suckers or superficial roots, which, in the case of grafts especially, may cause various accidents. It is also often used to bury manures or fertilizers in countries where it is customary to put them round the stumps."*

Apply chemical fertilizers.

Prepare nursery ground for grafted and ordinary cuttings. Select for this purpose a small block of the best land available. Trench 18 inches deep, by hand if possible, and apply a heavy dressing of farm-yard manure.

Select and bundle canes of European vines for scions and canes of American vines for stocks for grafting on the bench next month. The most convenient way is to cut these about 3 feet long, and make bundles of 50 according to size. Stratify these in moist clean river sand under a shed facing east, where they remain until you are ready to proceed with grafting.

* G. Foëx.

RELATIVE MERITS OF CEMENT AND WOODEN VATS IN WINE-MAKING.

By R. Dubois, B.Sc.

(*Continued from page 490.*)

It is said that one of the weak points of cement for storing wines is that the wine does not mature. This would seem to be true, as wood allows air to slowly pass through its pores and produce a slow oxydation to which maturation is partly due, while it is impossible for air to pass through even the thinnest cement wall in any appreciable quantity.

But is it always a good thing for a wine to mature? For certain full-bodied strong wines maturing is no doubt indispensable, but light wines do not mature; they become worn, without passing through intermediate stages, and often acquire their maximum of quality at the end of the winter following the vintage.

Bouffard and Büring, in the work already mentioned, prefer cement storing vats to any other for wines of this description. Further, full-bodied wines can always be aërated by racking if they do not mature quick enough.

Cement storing vats have also the advantage of saving loss by evaporation, which in wood reaches 2 per cent. per year at a low estimate. This would represent a loss of at least 200 gallons on a crop of 10,000 gallons.

When vats are emptied and are not to be used again, they should be thoroughly scrubbed and dried as quickly as possible by leaving the man-hole open. Moulds should never develop on the inside walls, and this can only be prevented by keeping the vat perfectly dry.

Before concluding this article, we must extract the following description of two interesting applications of Monier cement from a paper, written last year by Chabert for the *Progrès Agricole.** One refers to fermenting vats, the other to diffusion vats:—

"Mas-Nègre is a vineyard of 15 acres belonging to Mr. Pégurier and situated near Lattes, in the Hérault district. Two years ago the owner decided to alter the arrangement of his fermenting-house and replace the old wooden vats by vats made of Monier concrete. He had to be guided by the height of the elevator carrying the crushed vintage to the top of the distributing shoot. This shoot had a certain fall to allow the vintage to be automatically delivered into the vats. He was forced, therefore, to build what are considered in France low vats.

* *Le Progrès Agricole*, 1900, Vol. XXXIV.

On Roos' advice he erected three small vats of iron and cement concrete, 7 feet wide, 8 feet long, and 5 feet high. (Figs. 12 and 13.)

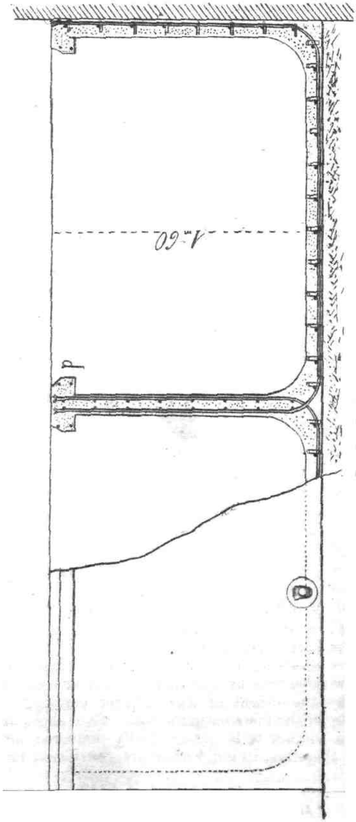


Fig. 12.—Vertical Section.

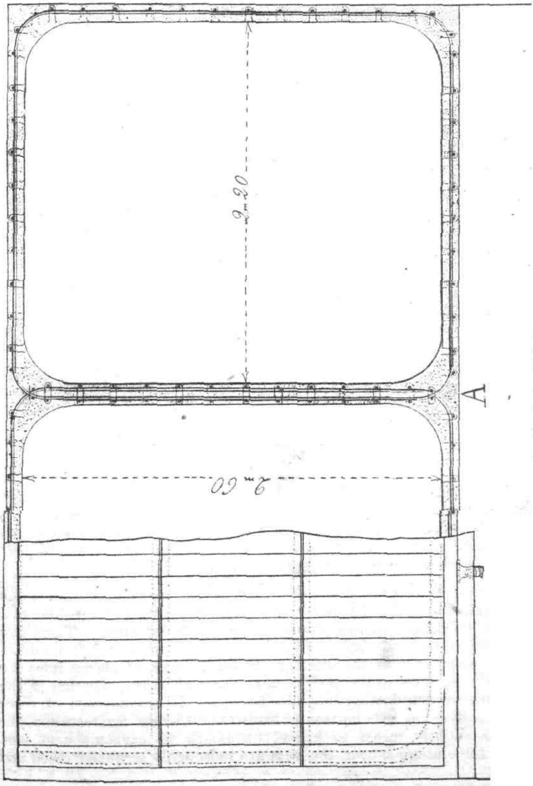


FIG. 13.—Horizontal Section.

The vats are veritable wire cages, imbedded in cement, as may easily be seen from the accompanying diagrams. Small hoop-iron stirrups bind the iron rods together and prevent any disjunction (these are represented by small crosses on Fig. 14). Along the bottom is a concrete beam carrying the walls.

FIG. 14.—Transverse Section.

A brass tap is placed in such a position that the vat may be easily emptied, not a drop of liquid remaining in it. It is important that it should be so, as if the tap is placed higher than the level of the bottom, must remains in the vat, which has to be taken out with a dipper —extra work which may be easily avoided.

There is no need for a man-hole in this case, as the marc can easily be shovelled over the side after the must is drawn through the tap. There is no danger of asphyxiation, the vat being open. The marc shovelled into a trolly is taken to the press, where it is left to drain before being taken to the diffusion battery. Fig. 13 shows how the iron rods interlock in the wall common to both vats. Portion of the moveable wooden flooring may also be seen. It is composed of three parts, resting on two horizontal timbers. During fermentation the floor is slightly raised to allow the escape of carbonic acid gas. When the vintage is over, the vats are thoroughly scrubbed, dried and closed.

The transverse section (Fig. 14) shows the details of construction, the dotted lines representing the iron rods. The angles require to be most carefully built. Fig. 16 shows the arrangement of the rods at

the corners, and Fig. 15 the hoop-iron stirrup keeping the rods in position.

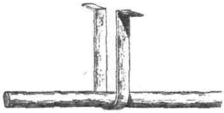


Fig. 15.—Iron stirrups binding the rods together.

Fig. 16.—Showing arrangements of iron rods at the corners.

In the above illustrations the angles are rounded; this is how they were built at first, but it was later on thought advisable to coat the inside walls with glass tiles, so that they were bevelled. These three vats have been in use for the last five years and have given every satisfaction; this is the reason which induced me to describe them, as similar vats may be found of great service in small vineyards.

The diffusion battery we are about to study, belongs to Messrs. Bories and Ramadié, of Courmontéral, and was built on Mr. Roos' plans. It is composed of twelve vats made of Monier concrete, and joined together in a straight line. It differs from the battery described by Roos at the Œnologic Congress of Toulon, in that the arrangement of the tubes conveying the liquids is rather an imitation of that used with a battery made of hogsheads.* Each vat is provided with two openings, one in the centre of the floor, the other 10 inches from the top, on the left. The tube conveying the liquids is bent so as to have its extremity *c* (Fig. 17) opening in the centre of the square formed by the four walls, that is to say equally distant from each angle. It is coupled on the outside with a rubber hose (*r*), connected with the vertical tube (*t*) of the next vat.

* A study of a diffusion battery made of hogsheads will be given shortly in this journal.

It can be readily seen (Fig. 17) how the liquid passes from one vat to another and through the whole battery. It rises from the

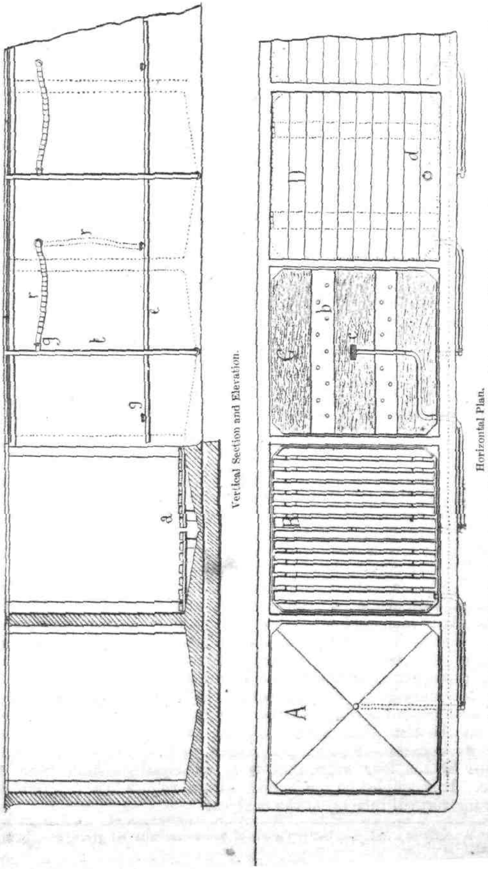


Fig. 17.—**A**, horizontal projection of a vat; **B**, horizontal projection of false bottom; **C**, projection of a vat filled with marc; **D**, projection of a vat with closed lid.

bottom of the vat, enters the tube (*c*) into the hose (*r*), descends through the vertical tube (*t*) into the centre of the bottom of next vat and so forth. This arrangement prevents air from lodging in the pipes, so that the circulation is not hindered and there is no extra pressure.

The wine is collected in the ninth vat, the three other vats serving as storage for marc. The hose (*r*) is used for that purpose, by coupling it with the horizontal tube (*e*), which runs from one end of the battery to the other. At one end is a small tank, level with the floor, into which the wine is collected.

The tanks at both extremities are connected by the hose (*r*) of the twelfth tank and the horizontal tube (*f*) (Fig. 18), which run alongside

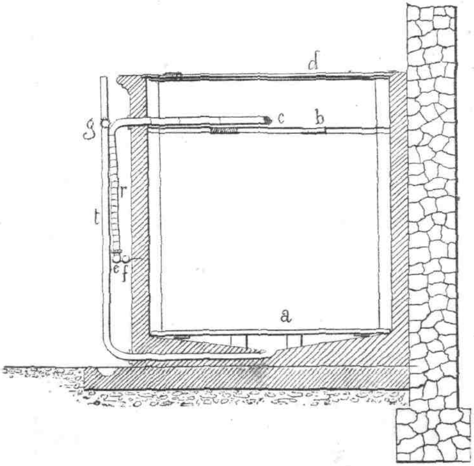


FIG. 18.—*Vertical Section of diffusion vat.*

the tube (*e*) and connects with the vertical tube (*t*) through another hose coupled at (*g*).

When the marc is exhausted, the vats have to be emptied from the water they contain. This is done by disconnecting the hose (*r*) (Fig. 18), loosening the coupling at the bottom of tube (*t*), and tipping it down into the drain which runs alongside the vats. The bottom of tube (*t*) could also be provided with a tap, kept closed during work.

Each vat has a false bottom (*a*), carried by two horizontal struts, and a false head (*b*) provided with a number of holes and engaging in grooves made in the cement work. The vats are provided with wooden lids hinged on the side near the wall. This prevents too great an aëration of the wine, and secures the exclusion of dust and dirt from the vats while the battery is working. These lids may be lifted and hooked to the wall at the back while the vats are being filled with marc.

Water is conveyed through a piping placed along the back wall, and carrying couplings and pieces of hose in suitable positions. The rate of flow is kept very regular (the main condition of success of this method of extracting wine from marc) by a tank in which the level of the water is kept constant by a tap and float."*

Monier concrete and Sidero-cement are used for all sorts of constructions, tanks, flooring, channels; cellars and fermenting-houses are even completely built upon this system as shown (Figs. 19 and 20 extracted from the *Progrès Agricole*, March, 1902). What we have said is sufficient, however, to show the possibilities this mode of construction offers to wine-makers here.

* We beg to refer those interested in this new method of treating grape marc to Andrieu's paper on *Treatment of Vintage by Diffusion*, translated in full, Parts 2 and 3 of the present journal, and also to Roos in *Progrès Agricole*, Nov., 1898.

[The last Plate accompanying this article, showing the interior of an Algerian wine-cellar, was the one referred to on page 488 of the May issue of this journal.]

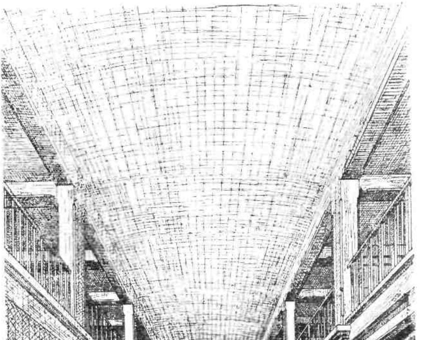


FIG. 19.—FERMENTING HOUSE OF MR. PELLEGRY (INSIDE VIEW).

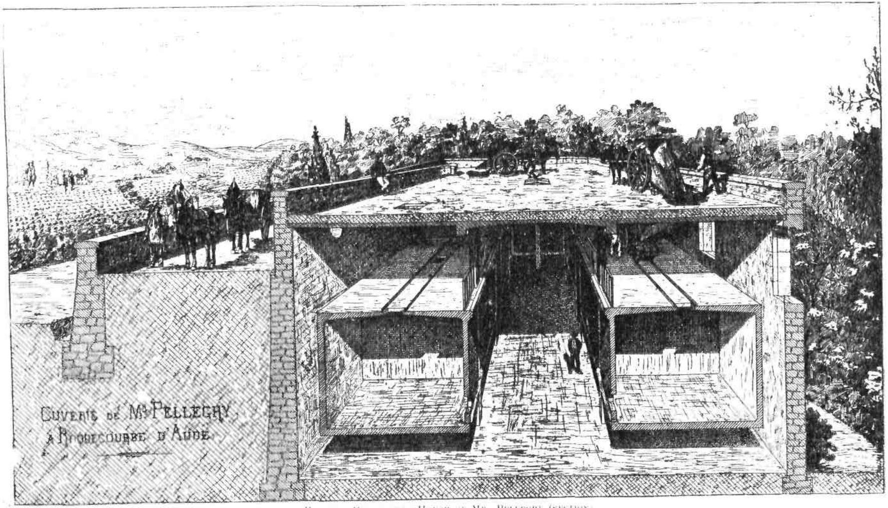
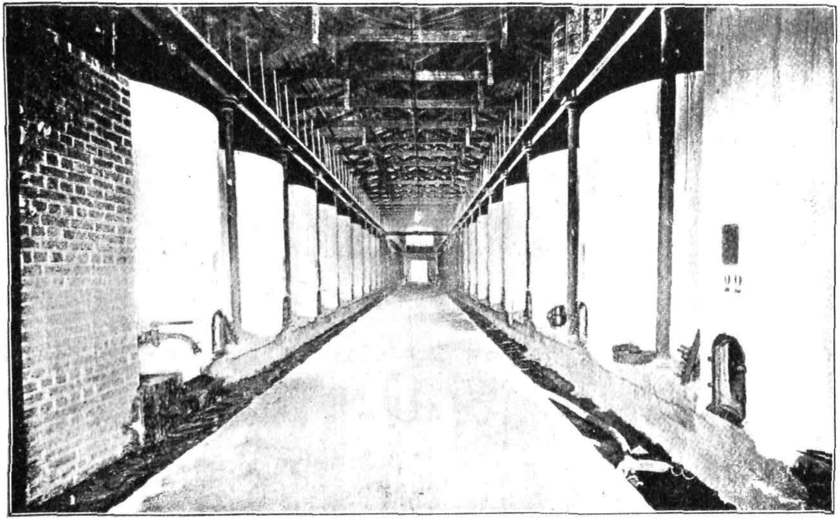


FIG. 20. FERMENTING HOUSE OF MR. PELLEGRY (SECTION).



CELLAR OF BON-ZÉHAR (ALGERIA).

VINE PRUNING.

By Joseph Perraud, Professor of Viticulture, Villefranche (Rhône), translated by Raymond Dubois and W. Percy Wilkinson.

COMPARATIVE STUDIES OF VARIOUS SYSTEMS.

General Considerations.

Principles of Pruning.

Pruning is one of the most important operations in vine culture. Its object is :—

1st. To promote, render regular, and increase the yield.

2nd. To obtain larger fruit of better quality, ripening early.

3rd. To give the plant a pre-determined shape and development, by distributing the sap more regularly among its different parts.

4th. To induce the fructification of vines which do not naturally bear grapes.

5th. To allow the performance of cultural operations as economically as possible.

Pruning is indispensable in viticulture, as the vine has a natural tendency to grow wood, and its spontaneous yield is insignificant.

The vigour of a plant may be in direct or inverse relation to its production. For instance, the greater the number of green shoots the more matters are elaborated, and, consequently, the fruit has a greater amount of nutritive matters at its disposal ; but when these matters are in excess they are drawn towards the buds, and are lost to the fruit : this is termed "*chloranthy.*" Therefore, enough shoots should be left to insure sufficient but not excessive vigour.

When, on the contrary, the vegetation of a plant is weak there is an abundant production of fruit. This fact would induce one to assume that the vigour of a vine should be diminished as much as possible, so as to obtain a greater number of grapes, but we know that large production weakens the plant, and, if it were continued for several consecutive years, would kill it. We should, therefore, maintain a just medium.

But how are we to know at the pruning season if a vine is too weak or too vigorous ?

Whenever a vine is too vigorous, suckers and gormands grow on the arms and the trunk; whenever a vine is too weak, some of the buds left at the previous pruning season do not develop. These indications are simple, and never fail.

It is a law of nature that the direction of a shoot has an influence on its vigour. Vertical shoots are more vigorous, but for this very reason they bear less fruit. Those on the contrary, which are more or less inclined, are weaker and more fructiferous. On a given shoot *the buds furthest from the centre in a vertical direction are those* which develop with the greatest strength.

Certain artificial means enable us to reduce the vigour of a shoot, and, therefore, to increase its production: bending it downwards, for instance, which is common in certain methods of training vines. It results from these remarks that in any system of pruning when vigorous and weak shoots are growing on the same plant, *an equilibrium can be established by placing the weaker shoots vertically and the stronger shoots horizontally.*

Vines bear fruit on shoots of the year grown on wood of the previous year; it is, therefore, indispensable to produce new wood every year, and for this object we should leave on the plant, besides fruit-bearing shoots, shoots which will serve to replace, the following season, those which have borne fruit. Shoots growing on old wood (gormands) do not generally bear fruit. However, this rule does not apply to very heavy bearers such as Aramon, which often bears fruit on gormands.

If all the canes are left unpruned on a vine, a considerable number of shoots will develop, bearing numerous but very small grapes. It is, therefore, necessary to remove every year a large number of canes, and to shorten those which are retained.

If several cépages are examined, it will be noticed that some, such as *Aramon*, *Carignane*, *Morrastel*, &c., only bear fruit on the shoots developed near the base of the canes of the previous year. In this case the base of the canes only should be retained; others, such as *Shiraz* (*Red Hermitage*), *Cabernet*, *Pinot* (*Burgundy*), *Mondeuse*, &c., bear fruit on shoots developed at the extremity of the canes: in this case longer pruning should be the rule; other cépages bear fruit on all the shoots: in this case the pruning may be long or short, without taking into account the above considerations.

We may, therefore, from this point of view, divide pruning into two groups: *Short or Spur pruning*, and *Long or Rod pruning*. The choice of one or other of these systems depends on the special peculiarities of each cépage.

A *short spur*, or simply *spur*, is a lignified cane cut back to two or three eyes. A *long rod*, or simply *rod*, is a cane bearing at least five eyes.

As a general rule, rods are more fructiferous than spurs, but they produce smaller grapes and less vigorous shoots; spurs, on the contrary, give less crop and more vigorous shoots. If a vine were always pruned with rods it would gradually get weaker. It is therefore necessary, even in the rod system of pruning, to preserve spurs, which

will furnish every year new fruit-bearing shoots to replace the rods which are removed after they have borne a crop. In the combined systems of pruning, the long rods are generally bent down, and the shoots growing on the spurs are tied vertically, so as to increase their development.

According to these principles we may practise *short pruning*, *combined spur and rod pruning*, but never exclusively *rod pruning*.

When the vigour of a variety is known, together with the system suiting it best, what canes should be retained? From the point of view of fructification, we should retain shoots of medium vigour: excessively strong shoots produce wood, and the weaker ones have an insufficient vegetation. The shoots retained should be well ripened and healthy.

We should always maintain a balance of growth between the different parts of a vine. The vigour of a weak arm may be increased by tying it up vertically, but this means is seldom adopted. The same object may be reached by leaving on that arm a greater number of spurs than on the other arms; by this means a greater surface of elaboration is obtained, and consequently there is a larger afflux of nutritive matters. But if this were continued for several years on the same arm its vigour would increase at the expense of the rest of the plant; therefore, if a vine is normally established, we should never leave a greater number of spurs on one arm than on the other. However, we may retain several spurs on one arm on the condition that the other arms will in turn bear the same number. We could also increase the vigour of an arm by leaving one single spur with one single eye, which will give rise to a very strong shoot.

As the sap has always a tendency to rush towards the highest part of a plant, it results that in all systems of pruning the arms have a tendency to become longer: this inconvenience can be avoided.

As the arm becomes longer it gets tortuous; the nutritive matters do not travel easily through it, and the sap does not reach the bud at its extremity, which consequently dies.

To avoid excessive elongation of the arms, we should, whenever possible, retain the spur lying closest to the old wood.

When an arm is too long it must be shortened by what is called "relief pruning." A single spur is left on the arm, and as its shoots will not be sufficient to utilize all the sap, water-shoots or gormands will burst out of the old wood; the following year the arm is cut back over the gormand which occupies the best position.

In certain districts, such as Bourgogne and Champagne, pruning is done contrary to these principles, the spurs being selected, as far as possible, from the trunk, but frequent layering, which is the custom of these districts, enables the arms to live underground.

The canes furnishing the spurs or rods are pruned through the node placed immediately above the last-retained bud. By doing so the *diaphragm*, or ligneous partition, is preserved, preventing water from penetrating the pith.

If the internodes are very long, a slanting terminal section is made opposite the bud to enable the water to drain away.

Pruning may be performed during the whole winter, from the middle of November to the end of March.* We should not, however, prune if the weather is very cold, for the canes are brittle, and the sections cannot be made regular.

Early or late pruning is not indifferent. The buds develop with greater rapidity when a few only are left on the stump, consequently we should prune as late as possible in districts where spring frosts are to be feared.

But with large areas, on account of cultural exigencies, the shoots which are not retained for spurs are removed altogether, and the others are cut at a foot to 16 inches from the plant, to be pruned, later on, to the required length. This first preparatory pruning is called, in the South of France, "*espoudassage*." †

Height and Shape of Vines.

Experience has shown, in all vine-growing regions, that the nearer the grapes are to the ground, without touching it, the earlier and more perfectly do they ripen their fruit. This is owing the sun's rays, striking the soil, and being reflected upon the surrounding objects; moreover, the soil, having been warmed during the day, throws off this heat during the night by radiation. Therefore, in cold climates, the fruit-bearing shoots should be as close as possible to the ground; but we must take into consideration another fact, and that is the cooling which takes place in winter or spring, which is sometimes very intense, and is the result of a radiative action similar to that which furnishes heat to the plant in summer.

Therefore in districts where frosts are to be feared the stumps should be sufficiently high, in order not to be affected by the radiative action of the soil.

In the South of France, on the contrary, if we only take into consideration the intensity of heat which is always sufficient to completely ripen the fruit, vines ought to be trained high, but in this case the solar rays heating the grapes directly may scorch them; on the other hand, as frosts are not to be feared, the vine stumps should be pruned as low as possible.

The numerous shapes given to vines may all be included under three types:—1st, *Gooseberry bush*; 2nd, *Spalier*; 3rd, *Cordons*.

The gooseberry bush shape is that in which all the arms radiate from one centre, and have a more or less open, conical shape. This system, used in Languedoc, Provence, Beaujolais, Roussillon, &c., has many advantages. The arms are equally spread all around the stump, which enables the soil to be covered with branches in hot regions, acting as mulching and sheltering the grapes from the sun.

With the *gooseberry bush* and stake system, used in Beaujolais, the branches may be tied up to the stake, and the grapes exposed to the sun. It has also the advantage of allowing short or long pruning as well as cross ploughing.

* May to August in Victoria.
† This method is termed *fall-pruning* in America.

The *spalier* may have different shapes, but the arms are always disposed round the centre symmetrically and in one plane. This disposition has the disadvantages of not allowing cross ploughing, and of exposing the grapes to the sun in hot climates. But it answers very well in countries where grapes require to be exposed directly to the sun's rays in order to reach complete maturity. On the other hand, spaliers require greater care and greater skill to maintain a balance of growth.

The *cordon* includes all the systems in which the arms take a single direction. (Bourgogne, Hermitage, Sylvoz, and Cazenave systems.) This shape offers the greatest facility of training, for the sap always travels on the same side, and one is not obliged to maintain the balance between the different parts.

We shall now study the different systems used in viticultural countries. In these studies we will take the vine from the start, that is to say, the first year of planting out, and follow it till complete development.

PART I.

SYSTEMS OF PRUNING IN VARIOUS VINE-GROWING REGIONS.

I.—Pruning in Languedoc.

This region, which includes the départements of the Hérault, Aude, Gard, and Camargue, is characterized by low-trained vines, pruned in the gooseberry bush system with spurs and without stakes.

The year of planting out, the young plant or cutting is pruned back to the second eye above ground, but a longer piece of wood is often left, removing the upper buds so as to render the young plant more visible at the time of ploughing. In low-lying ground where moisture is to be feared, the stump is trained at from 8 to 10 inches above the surface of the soil, and in this case three eyes instead of two are left on the cutting, which is tied to a small peg during the first two or three years.

On hills and in dry soils the vines are only trained from 4 to 6 inches in height. If the young plant grows vigorously, its shaping may begin at the first year. When the bud, placed on the best level for the future crown, gives two shoots (or, if without giving two shoots, two shoots growing closely together can be found on the cutting), these are pruned at the second or third eye, thus giving two spurs.

But if the young plant is too weak, or if the shoots are in the wrong positions, one single spur is left and pruned at a variable length; its two end buds forming the crown of the plant later on. If these two buds are at the required height the shaping of the plant is started, but if they are too low, or if the plant requires to be trained higher, the shoot is pruned at the fifth or sixth eye, being careful to leave only the two eyes of the extremities, and to remove all other eyes

If the plant is too weak one single bud is left so as to obtain a very vigorous shoot.

At the beginning of the second year, that is to say, after the first pruning, the young plant presents the aspect of Fig. 1 or Fig. 2.

Fig. 1.
First year's treatment.

Fig. 2.
Second year's treatment.

At the beginning of the third year, that is to say, before the third leaf, the second pruning is performed. Two, three, or four spurs may be left, according to strength and vigour, with two or three eyes (Fig. 3). At this age the vegetation of the young plant is generally most exuberant, and a large number of eyes should be left to prevent the young shoots from acquiring too great a development and getting broken. At this stage the only object should be to form the frame of the plant, without trying to obtain fruit. Four spurs are left whenever possible ; this happens rather rarely.

At the third leaf, that is to say, at the beginning of the fourth year, the vine may be considered as adult ; the canes are large and vigorous, and the frame-work established. One of the four spurs left the previous year is often removed, the other being pruned at the second eye. Six vigorous shoots are thus obtained, from which we will be able to form six spurs the following year (Fig. 4) ; but when the vigour is sufficient, four arms are retained.

As may be seen, four years are required to form the gooseberry bush, when the vegetation is sufficient and when no accident occurs. But often, when the vegetation is not sufficient and when the shoots grow in the wrong position, it takes five, and sometimes six, years to have the crown definitely established.

Once the frame-work is established, the pruning is continued every year, leaving one or two spurs of two eyes on every arm (Fig 5). The number of arms and spurs naturally varies with the vegetation of each vine and the natural richness of the fruit.

Fig. 3.
Third year's treatment.

Fig. 4.
Gooseberry Bush at the beginning of the fifth year (after Portes and Ruyssen).

Fig. 5.
Spur.

If the soil is not fertile, three or four arms alone are left, with five or six spurs, according to the vigour of the plant. But we should never leave supplementary spurs on the same arms for two years running. Further, if we wish to retain two spurs on one arm, always, when possible, select those growing from the same point. (Rabbit year.)

In soils of medium fertility, two arms with five or six spurs are left: in rich soils, five arms with seven or eight spurs. But, however great the fertility of the soil may be, never leave more than six arms with seven or eight spurs on the same plant (Fig. 6).

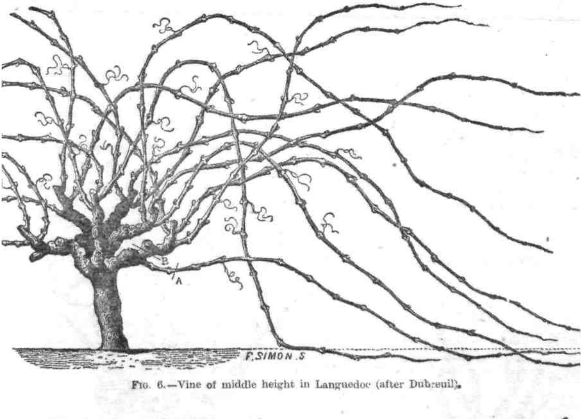


Fig. 6.—Vine of middle height in Languedoc (after Dubreuil).

As a rule, we should avoid accumulating old wood and allowing the arms to lengthen. With this object, always select, when forming spurs, vigorous canes, placed as close as possible to the old wood (*Fig.* 7). We should also try to preserve the regularity of the crown and the equilibrium between the different parts of the plant, the spurs being symmetrically placed on arms which are regularly spaced.

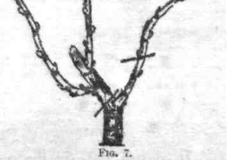


Fig. 7.
The lowest shoot is selected for spur.

This system answers very well in the South of France with the cépages cultivated there. It has the advantage in certain regions of covering the whole surface of the soil with green shoots, thus preserving the moisture.

The grapes are also placed in the same moist surroundings, sheltered from the sun and hot winds. Finally, the cépages cultivated in the South of France all require short pruning, for they all have the property of bearing fruit on the two eyes placed at the base of the shoot.

From an economical point of view, this system presents great advantages; it enables stakes to be dispensed with, renders cross-ploughing easy, and endows the plant with a long life and abundant production.

The gooseberry bush may also be pruned with rods. For instance, when old vines have become very vigorous, long rods of two kinds may be left—first, canes with five or six eyes, called *pisse-vin*, on account of the great number of grapes they bear (Fig. 8); or, second, shoots pruned at the tenth eye and curved in the shape of a circle.

The gooseberry bush in the South of France also includes another operation known under the name of "Lowering." Notwithstanding every precaution, the vine sometimes becomes too much loaded with old wood, which greatly weakens its vegetation. In such a case we should cut away the old wood above the young suckers growing on the arms, to give it new vigour. We have seen, in the general considerations, how one should artificially induce the growth of these suckers (page 591). Old stumps are lowered in this way, giving them new wood to recuperate their fertility (Fig. 9).

FIG. 8.
Vine with two *pisse-vin*.

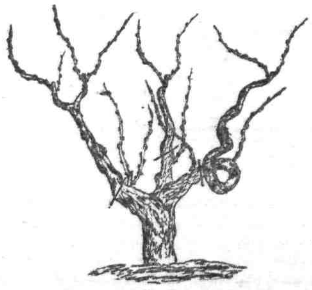


FIG. 9.
Shortening of unduly lengthened arms.

Pruning of Submerged Vines exposed to Frost.

In damp but fertile soils exposed to frosts, gooseberry bushes are trained to a height of 10 to 15 inches, loaded with spurs carrying rods with five or six eyes. These rods should be removed every year and replaced by new rods, as long as the vine does not seem to become weakened. These long rods greatly diminish the effects of winter frosts and allow a large crop to be obtained in certain seasons.

The pruning of submerged vines is also subject to other modifications. It may be performed before or after submersion without resulting in any ill effects to the plant. It is even preferable to prune away all canes which are not to furnish spurs, before submersion, and after to prune the retained canes to the second eye, definitely forming the gooseberry bush.

A distinction should be made between high and ordinary vines.

High vines are the rule in low parts of the submerged vineyard, and in the parts adjoining the banks; vines suffer greatly from humidity in such situations. It is for the same reason that Tinto, which is more resistant than Aramon to cryptogamic diseases or rots, is cultivated in such positions.

The crowns of these vines are formed about 20 to 24 inches above the surface of the soil. This is easily effected by a special pruning, which is done in the following way:—At the first pruning one cane 20 inches long is left and tied to a stake. This cane furnishes buds during the summer, some of which may bear fruit. Tinto trained in this way may yield 440 gallons per acre at the second leaf. At the second pruning three or four spurs are preserved at the extremity of this cane; at the fourth pruning the vine is definitely established with a crown 20 inches high. This method gives excellent results.

In Languedoc, summer pruning is not the general custom; Clairette alone is sometimes pinched. In some districts vines are rarely disbudded, except perhaps when they are loaded with leaves, and when special atmospheric conditions favour considerable herbaceous growth.

To sum up, gooseberry bush pruning such as is practised in Languedoc is of great simplicity, and gives full satisfaction to viticulturists. It endows the plant with a long life, and produces crops as economically as possible—crops which are sometimes exceptionally abundant.

II.—Pruning in Provence.

Formerly one could not find vast areas in Provence regularly planted with vines as is the case in Languedoc. The old plantations, called *manoullières,* were formed of quadruple lines of vines alternated with olive trees and beds of other plants (Fig. 10). Nowadays vineyards are generally planted in lines without any culture between them, and never in squares, or quincunx, as is the case in Languedoc.

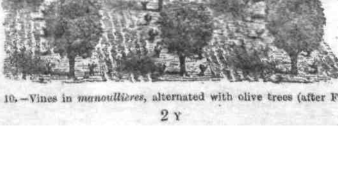


Fig. 10.—Vines in *manoullières*, alternated with olive trees (after Foëx).

In a general way, the system of pruning in Provence is too short. The vine has a gooseberry-bush shape with three arms, each bearing a spur of two eyes. This severe pruning causes rank growth on the old wood (Fig. 11). The shoots growing from the old wood are barren, and require to be removed to prevent them absorbing nourishment at the expense of the fruit-bearing shoots.

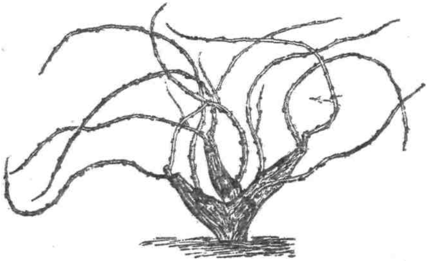


FIG. 11.—Vine of Provence, carrying gormands.

In Var, all the vines are pruned very low, with two arms the third year, and three the fourth, according to vigour.

The vegetation is generally very strong the first few years, but this excessively short pruning weakens the vine rapidly.

The first year the shoot is pruned with two eyes. Two vigorous shoots are thus obtained. The second year some vignerons prune these canes above the latent eye at *a* instead of at *b* or *c*—that is to say, over the second or third eye—and the shoots *d* and *f* are cut away (Fig. 12). The plant pruned in this way is mutilated, and the buds left cannot utilize all the sap the following spring. Many suckers

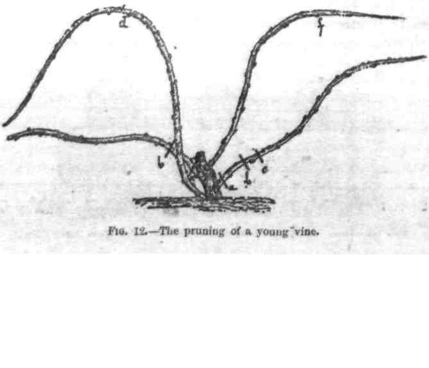


FIG. 12.—The pruning of a young vine.

develop on the old wood, and exhaust it, if they are not suppressed. The third year two arms are established (Fig. 13), and the fourth year three arms, or, rarely, four (Fig. 14).

In Bouches-du-Rhône, vines are often left without any pruning the first and sometimes the second year, so that after the third year it is necessary to remove everything level with the soil to start forming a regular crown. This deplorable method (if we may call it a method) destroys one or two year's crops. After this the vine is established with three arms, sometimes two, very rarely four.

Fig. 15 shows the shape of vines in Vaucluse. We may see how far this system is from the rational principles established at the beginning of these studies.

FIG. 13.
Three year old vine.

FIG. 14.
Four year old vine.

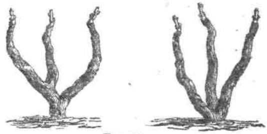


FIG. 15.
Old vines in Vaucluse (after Foëx).

In Provence, the symmetry of the vine is the main object; in Languedoc, on the contrary, production comes before shape. For these reasons the vines of Provence live up to 500 years, yielding regularly small crops, while in Languedoc the vines are generally exhausted after 50 years, although they have during this short time borne more crop than the Provence vines double their age.

However, these old methods are being little by little discarded and replaced by the Languedoc system.

III.—Pruning in Roussillon.

In this case, also, vines are trained in the gooseberry-bush fashion with low crowns. Each arm bears a spur generally pruned with one eye only. As in the two previous districts, the vines are not staked.

In Roussillon, vines are planted with a dibble, and the second year after planting they are cut level with the soil, so as to induce the growth of a vigorous shoot which will serve as foundation wood (Figs. 16 and 17). The third year the vine has the aspect shown in Fig. 18.

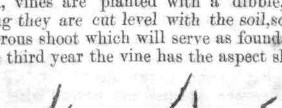


FIG. 16. FIG. 17. FIG. 18.
Vine at 1st, 2nd, and 3rd year of plantation.

The following year the vine is pruned with two or three arms, without following any rule as to regularity (Fig. 20). One single spur with one single eye is generally left on each arm, sometimes, but rarely, two, and, as might be expected, the crops are very small on vines pruned in this way.

No summer pruning is ever done in this district, where winter pruning, generally too severe, is never done according to the physiological principles which should always guide viticulturists.

The number of arms left on each stump is too small, and the spurs are *too short. The enormous rank growth (Fig. 19) proves that this* system, favorable to the production of wood, could be greatly improved by leaving a larger number of fruit-bearing buds, which would increase the production, as well as the vigour of the plant.

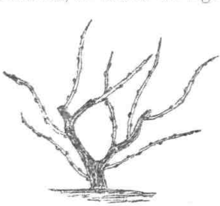


FIG. 19.
Adult vine before pruning.

FIG. 20.
Adult vine after pruning.

IV.—PRUNING IN CHARANTES.

The various viticultural regions of the Charantes may be characterized by their systems of pruning. While low gooseberry bushes are the general rule, vines affect many different shapes, varying between the ordinary gooseberry bush and the plant lying flat on the ground, having a shape somewhat similar to that of a mushroom.

The planting is performed with a dibble, and, after planting, the cuttings are pruned level with the soil, or above two or three eyes. There is generally no pruning done the first year. Usually after the third year, and rarely after the second, the first pruning is made. The young plant has by that time a very bushy appearance.

This first pruning is done in two ways: 1st, two or three branches in suitable positions are selected and pruned with two eyes, all the rest being pruned away. 2nd. The whole bush is cut level with the soil. *This latter process, which mutilates the plant, should be* discarded.

The fourth or fifth year three or four spurs are left to form the arm.

At Cognac, vines may be seen with eight or nine arms, more generally five or six, and rarely four. In other vineyards the number of arms is not so considerable. For instance, at Barbézieux, where

vines may be seen carrying seven or eight arms, the general rule is only three arms, and in the surroundings of Angoulême, vines with two arms and often only one are found.

At Cognac, each arm carries one single spur, with four or five eyes Figure 21 shows the type of pruning adopted for Folle-Blanche. This pruning explains the heavy crops obtained in that district.

At Barbézieux the pruning is not so liberal, and less regular Fewer arms are left on the stump, and when two spurs are retained on the same arm, they are pruned shorter than at Cognac. Two or three eyes only are left (Figs. 22 and 23).

FIG. 21.

ine of Cognac after pruning.

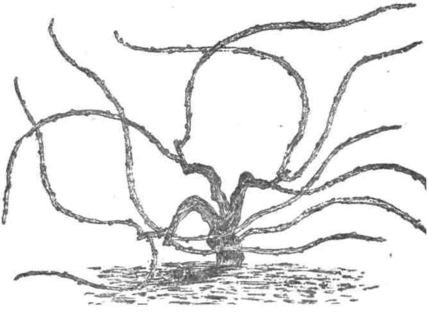


FIG. 22.

Vine of Barbézieux before pruning.

At Angoulême the old vines have generally two arms, and sometimes only one (Figs. 24 and 25). Now, in forming new vineyards, the Cognac system is always applied.

FIG. 23.

Vine of Barbézieux after pruning.

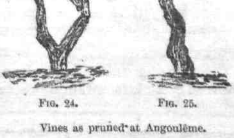


FIG. 24. FIG. 25.

Vines as pruned at Angoulême.

In Aunis, vines are submitted to a very special system of pruning. The crown is made flat, and the union of all the arms forms a kind of irregular disc placed on the surface of the soil, almost underground (Fig. 26). To obtain such a shape, all the shoots growing on the collar of the plant are pruned very short. We obtain in this manner five or six arms with one eye only, which soon produces large nodosities, touching each other and forming a kind of round and irregular plate (Fig. 27). From this plate short stout arms protrude, which carry

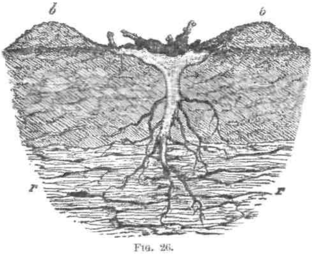


FIG. 26.
Vertical section of a growing vine in Charente-Inférieure (after Foëx).

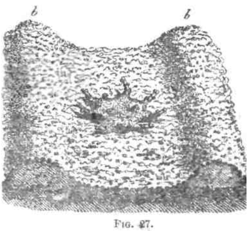


FIG. 27.
Vine of Charente-Inférieure (after Foëx).

all the shoots, some of which are removed and others pruned very short, with one or two eyes, according to the vegetation of the plant. When the arm has ceased bearing and has to be replaced, one sucker naturally growing under that plate is pruned with two eyes. Two years after this sucker has become an arm carrying fructiferous shoots. The production is preserved in this way. This is a barbarous method, from which, however, the Folle-Blanche and Colombar do not seem to suffer too much.

Spur pruning is not exclusively used with this method; sometimes one or two long rods are retained and bent down in the shape of a hoop.

The very short pruning applied in the vineyards of Charente-Inférieure promotes during the first year a considerable woody growth, and therefore small production. This may be easily remedied by leaving a larger number of fructiferous buds at the base of the plant. This excessive wood growth quickly weakens the plant, which when twenty years old has already lost most of its vigour. But what is lost in wood is gained in fruit, and at 40 years, when the production of wood is greatly diminished, the crops become more abundant.

The pruning takes place from the middle of December to the end of March,* and is often done twice, as is the case in the Hérault.

* June to August in Victoria.

The first operation, called "*Fiancailles*," is done in December or January, removing all the useless shoots, which cannot serve to form spurs.*

The various summer prunings are not customary in Charantes, and the vines are trained without stakes.

In Vendée, Indre, Loire-Inférieure, Loiret, vines are trained very much after the fashion adopted in Charantes. For instance, in Vendée the Folle-Blanche is pruned so as to form an irregular disc 5 or 6 inches above the surface of the soil, with five spurs of one eye and a long loose rod (Fig. 28).

In Loiret the vines have very much the appearance of those cultivated in Aunis, with some slight differences, which it is interesting to point out.

The vines are regularly planted, and have the shape of mushroom heads lying flat on the ground (Fig. 29). From this head

FIG. 28.

Folle-Blanche vine pruned after the Vendée custom.

FIG. 29.

Mushroom Heads of Gatinais (after Dr. Guyot)

fruit-bearing spurs shoot out, without arms. This method of leaving only one eye on the spur results in most fantastic shapes (Figs. 30, 31,

FIG. 30.

FIG. 31.

Various methods of training vines adopted in Aunis (after Dubreuil).

* This method of pruning vines twice is termed in America "fall pruning."—(TRANS.)

32). These mushroom heads are obtained by leaving, the first year one single shoot pruned back to one eye, the second year by pruning all the shoots to one eye, and the third year by pruning the five or six most vigorous shoots to one eye, and completely removing the others.

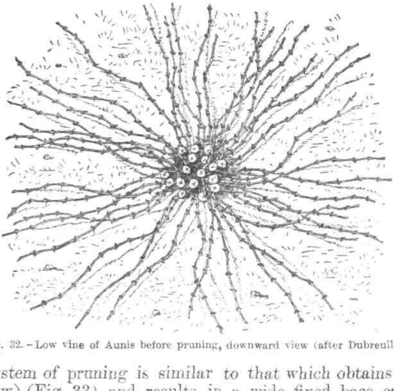


FIG. 32.—Low vine of Aunis before pruning, downward view (after Dubreuil).

This system of pruning is similar to that which obtains with the osier (willow) (Fig. 33), and results in a wide fixed base carrying a number of eyes, from which shoots grow, maintaining their upright position without stakes.

But this saving of stakes results in a loss, for, with such a system the vine never reaches its maximum of production. Formerly the pruning system of Loiret was always with single eye spurs. However, it tends now to be replaced by spurs of two eyes. In Loiret the canes are fastened together above the crown of the vine (Fig. 34); this has

FIG. 33.
Osier head (after Dubreuil).

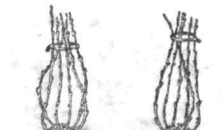


FIG. 34.
Loiret method of pruning (after Portes and Ruyssen).

an advantage over the system prevailing in Aunis, for the grapes are better exposed to the solar rays, but the fructiferous buds are still too near the ground, and exposed to spring frosts.

Before ending this study of the curious methods of training vines in this region of France, we must say a word about the vineyards of Orleans.

The osier system still prevails in Orleans, but yet it differs completely from those we have studied. In this case each plant is provided with a number of stakes equal to the number of arms left upon it. The vines are generally planted in the quincunx method, 31 inches apart, the soil being more or less raised in a ridge between the line of vines according to the season. A spur with one eye, another with two eyes, a rod with five or six eyes, and a long rod 24 or 31 inches in length are left on the mushroom head. At the beginning the long rods are tied together to long stakes, and, further, the extremity of the longer rod is fixed to a smaller stake driven in the centre of the ridge (Fig. 35).

There are often two, and sometimes three, long rods on one mushroom head, the new long rod being derived from the old ones, which results in a constant elongation of the arms supported by the long stakes.

Vines trained in this manner are not generally pruned the first year. The second and third years they are pruned with one eye only, to obtain the osier head ; the fourth year one or two spurs with two eyes and a long rod with five eyes are left. This long rod is often preserved at the fifth year only, and the following year a longer rod or *viette* is left. When the plant is eight years old it is definitely shaped with two spurs and two rods. This system has the disadvantage of accumulating, in time, a mass of old wood on the vine, and therefore of diminishing its fertility. It has been modified in many districts. At Château neuf, for instance, the vine is trained, as we have just explained, up to four years old. At that age it carries a spur with two eyes, a short and a long rod, which is bent down in the shape of a hoop, having at its base a replacement spur (Fig. 36). In this case one stake is sufficient to support the whole growth.

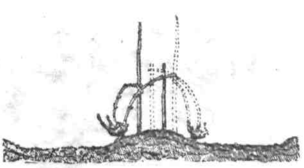


FIG. 35.

Method of training vines in Orleans (after Dr. Guyot).

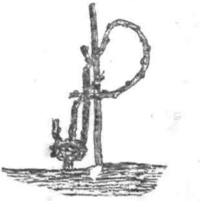


FIG. 36.

Method of training vines at Château neuf.

In Indre, vines are cut back to one eye the first year. The second and third year all the shoots are again cut back to one eye ; the fourth year, four or five canes are selected in suitable positions and pruned

with two eyes. All others are removed. These spurs form shapeless arms protruding out of this osier head; a long rod with five or six eyes is often retained (Fig. 37).

FIG. 37.
Method of training vines in Indre.

At La Châtre vines are trained differently. The first year all the shoots are cut back to one eye, but the following years three or four arms are retained, each carrying one or two spurs with two eyes. In this case vines do not affect the shape of mushroom heads.

In a general way, the methods of Charantes extended all over the neighbouring viticultural regions, together with its most cultivated cépages (Folle-Blanche and Mataro) and its general cultural methods.

(*To be continued.*)

TOBACCO CULTURE IN QUEENSLAND.

Mr. Temple Smith, who was deputed by the Minister of Agriculture (Mr. Morrissey) to visit Queensland and inquire into the condition of the tobacco-growing industry, reports that, in company with the Queensland expert, he proceeded to the Texas district of that State, where the finest leaf is produced. The text of the report presented by him to the Minister is as follows:—

The soils on which the best leaf is grown are rich alluvial flats, 6 to 12 feet in depth, containing a large percentage of sand, with a gravel subsoil which allows of free drainage. They are very similar in appearance to the river flats in the north-east of Victoria, on which the best leaf is grown. The altitude of Texas is about 1,400 feet above sea-level.

The sowing and transplanting seasons are identical with those in Victoria, and the harvesting of the crop was being finished during my visit. The yield this season is estimated at about 70 tons, as against 275 tons in ordinary years, the drought being responsible for the shortage.

The crop is produced almost entirely by Chinese on the share system, the usual proportions paid to them being three-fourths of the crop, the land-owner finding the shed, land, and ploughing, the tenant doing all the labour attached to growing and curing for market. The methods of cultivation are the same as those followed in Victoria, the chief variety grown being the Shoe-string, a tobacco resembling the Pryor family. The yield in good seasons is from 800 lbs. to 1,500 lbs. per acre, and prices have been obtained from 6d. to 9d. per lb. The latter price was paid by Messrs. W. D. and H. O. Wills for a parcel of 12 tons, during my visit, to one producer.

The sheds in which the leaf is cured by the Chinese are built of bush timber, the dimensions being 40 feet in width to from 60 feet to 150 feet in length; they hold from four to five tiers of tobacco in height, the eaves of the skillian coming to within 7 feet of the ground. The sides are left open, and fires are rarely used in curing, the influence of sun and air being considered sufficient. The Queensland expert, however, has built closed sheds of wood, and cures his leaf by putting open fires under the tobacco until dried out. I was shown some very fine leaf cured in this way from the crop of 1900-1901.

I have secured a quantity of seed from the expert of the best varieties grown in Texas for distribution in Victoria to growers. The leaf is graded into firsts and seconds, and packed in bales by all the producers, with the exception of the Government expert, who puts his leaf into hogsheads, this latter system having many advantages over baling.

With reference to diseases, the blue mould is the greatest enemy the planter has to contend with, the early plants especially being frequently attacked. No effectual remedy for the prevention or cure of this disease has been discovered, but it is stated by some of the planters that if the seed-beds are made high in the centre they are less liable to contract the mould. The insect pests are practically the same as in Victoria. Hailstorms are a great source of loss in some seasons, and in this respect Queensland growers suffer to a greater extent than we do.

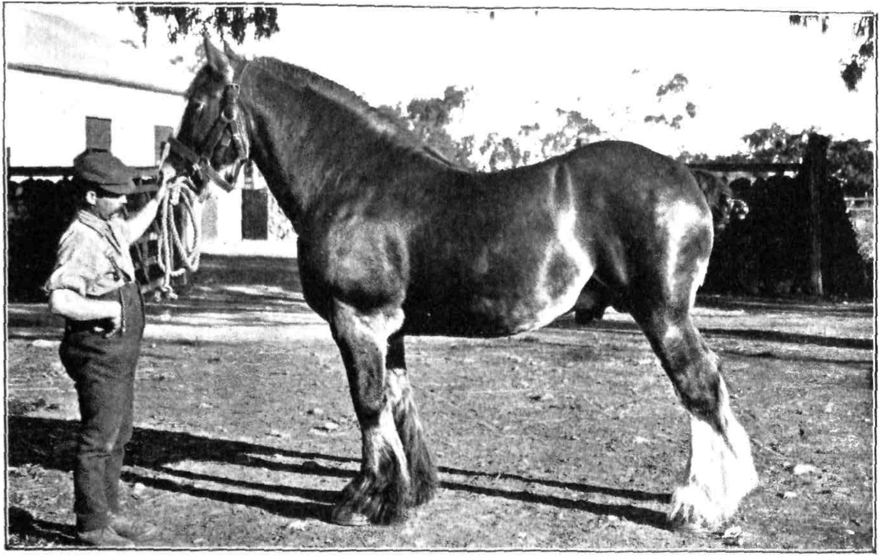
On my return journey I interviewed the Under-Secretary, Mr. McDermott, and arranged for a visit from Mr. Nevill in June next. I also obtained a complete chart of the analysis of the Queensland tobacco soils

as compared with American, viz., "Kentucky." A careful analysis of Victorian tobacco soil is being prepared, and a comparative chart showing the constituent parts in all three mentioned will be published when ready.

I also called upon the principal manufacturers in Brisbane, and was shown a sample of leaf purchased in Victoria, which the buyer stated he was so pleased with that he had bought another ten (10) tons. In passing through Sydney I called on Messrs. W. D. and H. O. Wills, who also have purchased some Victorian leaf, and have asked me to forward more samples, which, if suitable for their requirements, they will buy up to 50 or 60 tons.

From general observation and information elicited in Queensland, I am of the opinion that we in Victoria can produce tobacco nearly, if not quite, equal to Texas leaf. The area around Texas is not unlimited, and it will be many years before Queensland produces more good leaf than is sufficient for her own requirements. The drought, hailstorms, and blue mould all tend to make the crops uncertain. The proportion of Chinese growers to European is greater than in Victoria, and is likely to remain so, owing to the fact that the bulk of the work of growing is performed during the hottest months of the summer.

In conclusion, I desire to state that I received the greatest courtesy from Messrs. McDermott, Nevill, and others with whom I came in contact, and every effort was made to assist me in obtaining the information I required.



FEDERATION.

LORD DUNDONALD.

CHIEF INSPECTOR OF STOCK'S BRANCH.

IMPORTED STALLIONS.

By J. R. Weir.

The two Clydesdale stallions, Lord Dundonald (11094) and Federation (11034), recently purchased by Mr. S. W. Gibson, of Fenwick Stud Farm, Yan Yean, from Mr. James Kilpatrick, Craigie Mains, Kilmarnock, Scotland, arrived in Victoria ex s.s. *Salamis* in splendid health and condition, and have passed through their term of quarantine satisfactorily. They are now located at their owner's stud farm, Yan Yean, and doubtless will be eagerly sought after by the Clydesdale breeders of this State who require quality, bone, and plenty of feather, with any amount of action.

The *Scottish Farmer* of 25th January contains a highly flattering account of these two horses, from which we judge that Lord Dundonald was regarded as one of the best three horses of his year. He is by Lord Carrick (10270), a noted prize winner, out of Kate Park (13007). Federation is said to be an ideal horse for Australian conditions. He was got by Gallant Barossie (11043), a grandson of Prince of Wales, out of a Glenalbyn mare.

In this number we reproduce photographs of these two stallions, recently taken at Yan Yean.

THE FARRIERS BILL OF VICTORIA.

By W. T. Kendall, M.R.C.V.S.

Few people are aware how much we are indebted to the horse for our present state of civilization. It has been stated that next to the discovery of iron the domestication of the horse has done more than anything else towards the advancement of civilization. In times of peace he has helped to cultivate the soil and carried the materials to build our towns and cities, besides contributing to our comfort and enjoyment in a hundred different ways, whilst in war time he has been, and is still, indispensable. In spite of bicycles, motor cars, and steam ploughs he still holds his own, and probably never in the history of warfare has he played so important a rôle as during the present South African campaign.

Cuvier has stated that but for the bare space of gum between the incisor and molar teeth, which affords space for the action of the bit, the horse would never have been subjected to the power of man. It may, however, be said with greater truth that his utility would have been curtailed to a far greater extent but for his splendidly adapted foot, which, with the aid of shoes, enables him to stand continuous work for years, and he certainly could have been subjected without the aid of the ordinary bit.

The advantage of protecting the horse's hoof from inordinate wear by means of a shoe of some kind has been known and practised for centuries, and the farrier's art has always been considered an honorable one. In the sixth century the court smith of the Anglo-Saxon King Ethelbert was a highly privileged individual, and had only half the ordinary fine to pay for killing a man.

The art is ancient as well as honorable, but, unfortunately, in this country the trade for want of legislation or control of some kind has degenerated into a kind of "go-as-you-please." The old and sound practice of serving a seven years' apprenticeship has been abandoned, and young men who have seen a couple of years' service in a shoeing forge start in business as fully-fledged farriers without let or hindrance. The result of this is that a great number of horses are permanently crippled, and their working life curtailed by at least two-thirds. Not having the means of knowing whether a smith is competent or not, horse-owners are in the habit of allowing their horses to be sent to the nearest or cheapest (?) shoer, and the horse and owner both suffer in consequence.

There are as good and reliable men in the trade here as in any part of the world, but they find it difficult to retain their custom when having to compete with incompetent undercutters.

The horse, the owner, and the farrier are all injuriously affected by the present deplorable state of the trade, and it is with the view of bringing about a radical change and trying to elevate farriery to something like the position it deserves and once held that the Farriers

Association of Victoria have had a Bill drafted and placed in the hands of the Honorable the Minister of Agriculture to bring before Parliament during next session.

The object of the Bill is to enable those requiring the aid of a farrier to distinguish between qualified and unqualified practitioners, and provides for the establishment of a Farriers Board and the regulation of the practice of farriery in Victoria.

The sections of the Bill are arranged as follows :—

Part I. The Farriers Board of Victoria.

Part II. The Farriers' Register of Victoria.

Part III. Registered farriers, journeymen farriers, and farriers' apprentices.

Part IV. Miscellaneous.

The Board is to consist of seven members—five registered farriers and two registered veterinary surgeons. The Board to have power to appoint a registrar and to examine on oath any applicant for registration.

A register of all persons certified by the Board as duly qualified for registration as farriers or journeymen farriers and a description of their qualification is to be kept.

No person shall receive from the Board a certificate that he is duly qualified for registration as a registered farrier unless he has attained the age of 21 years, and no person shall be registered as a farrier—,

(1) Unless he holds a certificate or diploma of competency as a farrier from the Worshipful Company of Farriers of Great Britain, or from the Farriers Board of Victoria, or from a farriers' school or college recognised by the Board under the regulations made under the Act, or unless he has been continuously carrying on business on his own account in Victoria as a farrier throughout the two years immediately preceding the commencement of the Act ; or

(2) Unless he has been engaged as an employé doing farriery work for not less than three years immediately preceding the commencement of the Act ; or

(3) Unless he has been an apprentice with a farrier for not less than five years, and has passed an examination in each of the following subjects before the Board, or before examiners appointed by the Board, and such examination shall include the following subjects :—

(*a*) Anatomy and physiology of the foot of the horse.

(*b*) Taking off shoes, preparing feet, nailing on, and finishing off.

(*c*) Making and fitting any class of shoes determined by the examiners ; together with any other subject bearing on farriery practice which may have been prescribed by the Board, with the approval of the Governor in Council, and for which examination the Board's diploma shall be produced.

No farrier shall after six months from the commencement of the Act be entitled to employ or permit to do farrier's work on his premises any person not registered under this Act as a farrier or journeyman farrier or farrier's apprentice, or the holder of an unexpired permit.

Every person offending against the provisions of the Act shall forfeit and pay a sum not exceeding £50, to be recovered in a summary manner before any two Justices of the Peace, by any person suing for the same in any Court of Petty Sessions.

Registered farriers are entitled to sue in any court of competent jurisdiction for their fees and charges for farriery services, advice, or attendance rendered by them.

Registered journeymen farriers and apprentices can also sue for their wages.

Notwithstanding the provisions of the Act any general smith, coach-builder, wheelwright, or widow of deceased registered farrier may use the term or carry on the business of a farrier, provided always that all farriery work is done by a registered farrier or a registered journeyman farrier, who may also have under him registered farriers' apprentices.

ANIMAL PARASITES.

By A. A. Brown, M.B., B.S.

No. 5.

Tapeworms of the Dog.

The intestines of the dog are inhabited by many species of tapeworms which, during the course of development, find a refuge in the hydatid stages in the bodies of many animals. The dog is a great element of danger to the health of man, swine, oxen, sheep, rabbits, and hares. The Taenia echinococcus, a little tapeworm in the dog, one-sixth of an inch in length, and possessing four segments, has a most important bearing upon the health of the human subject. The hydatid stages of this worm are passed in the lungs, liver, and brain of man, and it may also pass the same stages in the pig. It is the principal cause of hydatids in man, and hydatids are common disorders amongst people in many districts of Victoria.

Man and the dog are always found in association, and the privileges of companionship enjoyed by the dog of roaming over gardens and being allowed access to watercourses from which domestic supplies are drawn, leads in the end to man's invasion by the embryos of this worm that inhabits in its adult form the intestines of the dog. The dog scatters the eggs of the worm that will develop into hydatids in the lungs, liver, and brain of man, with its dung, leaving them directly on plants or in watercourses. Notwithstanding the danger presented by our close association with the dog, hydatids are preventable diseases if sufficient trouble be taken with the food and water supplies. If due care be exercised, particularly in country districts where water is drawn from sources open to all sorts of contamination, in seeing that it is boiled or properly filtered, or precipitated by alum and soda before use, and also in seeing that no uncooked vegetables are consumed, then the danger of contracting hydatids is reduced to a minimum if not actually abolished. In both man and the pig the hydatid cysts may attain a large size, and in the cysts many heads that will eventually form the worms may be found. A large cyst may contain within it other cysts that have budded off from it. The flesh of the pig in some countries is occasionally seen to be infested with very small cysts, causing the disease known as "measles." In Victorian pigs the disease has not yet been observed, and it is a preventable disorder in pigs. The "measly" condition is due, no doubt, to a whole proglottis or segment having been swallowed, thereby introducing at once into the system multitudes of eggs. The embryos being soon set free in that organ bore into its walls and gain the blood stream, and by it are carried all over the body, encysting themselves not only in the organs but also in the muscles or flesh.

The carcasses of pigs affected with "measles" and any organs containing hydatids should be destroyed by fire. On no account should infested organs or flesh be thrown to dogs, for in their intestines the hydatids would develop into tapeworms. It is by means of impure water, uncooked vegetables, and hands contaminated by excrementitious matters of dogs infested with tapeworms that the eggs of the Taenia echinococcus reach the human stomach. Dogs should not be allowed to roam over the watersheds of reservoirs, or over gardens in which vegetables are growing for human consumption, inasmuch as they frequently enough drop segments of the worms there. The consumption of watercress from unknown sources should be absolutely interdicted, as there is grave danger of its introducing into the system the eggs of tapeworms.

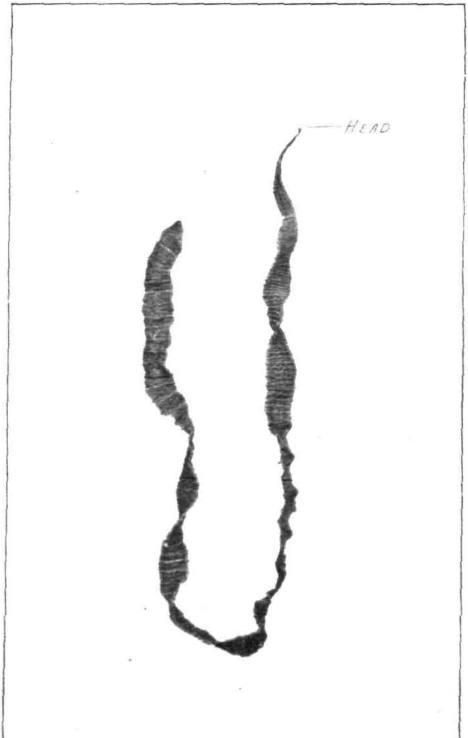
The Taenia marginata, a tapeworm commonly met with in the dog, may attain a length of from five to eight feet. Its hydatid stage is passed in the sheep. It is there called the Cysticercus tenuicollis or slender-necked hydatid. It may be found in the lungs, liver, mesentery, and omentum of sheep. No portion of a sheep's carcase affected with hydatids should be given to dogs. All affected portions should be destroyed by fire.

The Taenia coenurus, ranging from two to four feet in length, is, fortunately a rare tapeworm in the dogs of this country. Its hydatid stage is passed in the brain of the sheep, causing that fatal disease known as water-brain, vertigo, staggers, or gid. This bladder worm has on its surface numerous small heads, each of which when swallowed by a dog becomes a mature tapeworm in the dog's intestine.

A dog, then, that swallows a cyst from the brain of the sheep may become invaded with many tapeworms. In the sheep the hydatid produces symptoms that vary according to its situation in the brain. When situated in the cerebrum, or larger division of the brain, it produces disturbance of the centres which control movement from the pressure it exerts, and the animal may be seen to turn round and round in one direction. When the cyst is situated in the cerebellum, or smaller division of the brain, the same symptoms may be produced, but blindness may be superadded. When the cyst is situated in the fourth ventricle of the brain, the animal, instead of turning round and round, springs into the air. To prevent the dog from becoming invaded by this tapeworm it is necessary to see that the heads of all sheep suffering from gid are destroyed by fire.

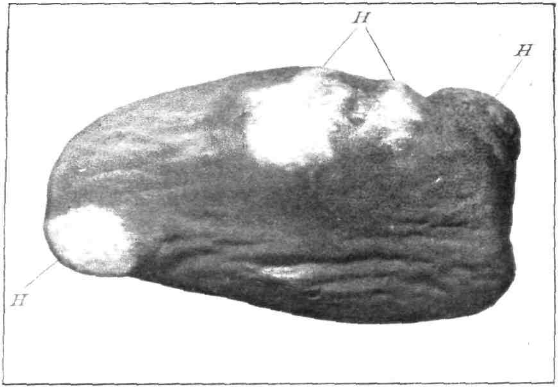
The Taenia serrata, from two to three feet in length, is, judging by the frequency of the occurrence of hydatids in rabbits, an extremely common tapeworm. The hydatid stage of its existence is passed in the hare and the rabbit, and it is not by any means a rare thing to encounter the cysts in the bodies of rabbits. Rabbits in which hydatids or blisters are found should always be burnt. The blisters will unfailingly give rise to tapeworms if swallowed by dogs.

The Taenia cucumerina, a little tapeworm, ten to twenty inches in length, inhabits the dog's intestines. Its life history is very curious. Its hydatid stage is not passed in the body of any animal upon which

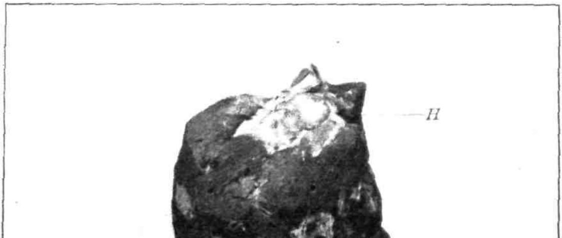


A COMMON TAPE-WORM IN DOG (TÆNIA MARGINATA)

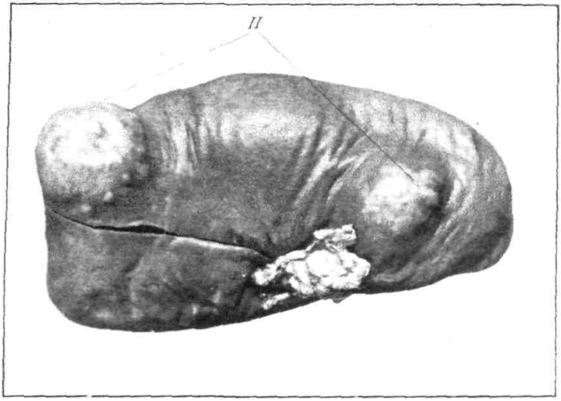
3 Feet in Length.



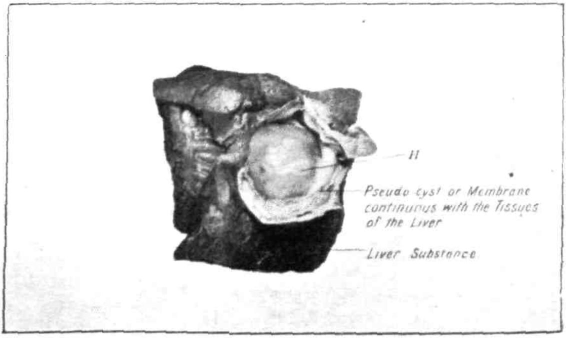
KIDNEY OF PIG, SHEWING HYDATIDS (H) EMBEDDED IN ITS SUBSTANCE.



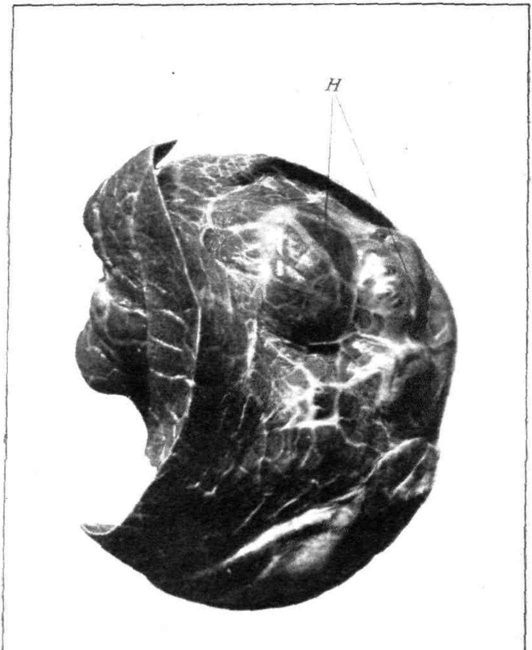
PIECE OF LIVER, SHEWING HYDATIDS (H).



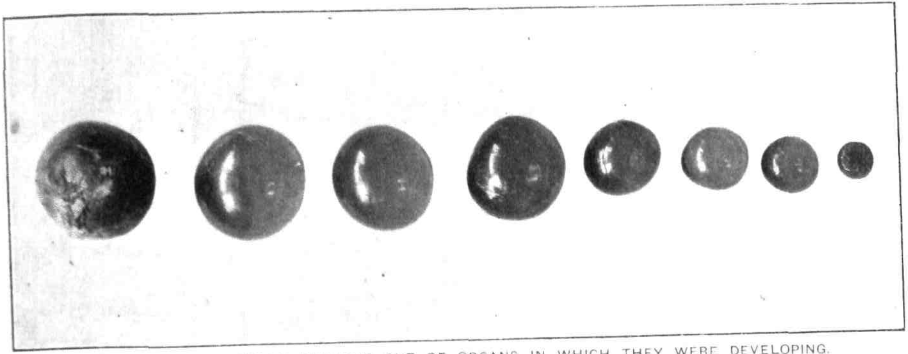
HYDATIDS (H) IN KIDNEY OF PIG.



HYDATID (H) IN LIVER OF PIG.



HYDATID CYSTS (H) IN LUNG OF PIG.



HYDATID CYSTS (SMALL) SHELLED OUT OF ORGANS IN WHICH THEY WERE DEVELOPING.

the dog preys, but is passed in the body of a little creature that preys upon the dog himself. Its cystic stage is passed in the body of the louse of the dog—the Trichodectes latus. The segments of the worm having escaped from the dog's intestines crawl on his body, and then bursting scatter the eggs over his coat. The dog louse then devours the eggs, and in the body of the dog louse each egg attains the nearly solid cystic state. The dog in devouring the louse from off its body introduces the embryos of the tapeworm into his stomach along with it. To prevent dogs from becoming infested with this worm they should be kept free of lice, and the embryos not finding the intermediary host in which to pass a stage of their existence soon perish.

Treatment.

To expel tapeworms from dogs no remedy succeeds as well as areca nut. The dog should be kept off food for about twelve hours and then 15–60 grains of powdered areca nut should be given in a little milk. A dose of 30 grains will suffice for a dog weighing 25 pounds, and 60 grains may be given to a very large dog, and 15 grains to a little one. About a couple of hours after the administration of the areca nut a dose of castor oil should be given and the dejecta watched for the segments or joints, which may be seen to begin crawling about, and these should be burnt before they get a chance to burst and scatter the eggs which they contain.

PLATE I.

PEACH AND PLUM RUST

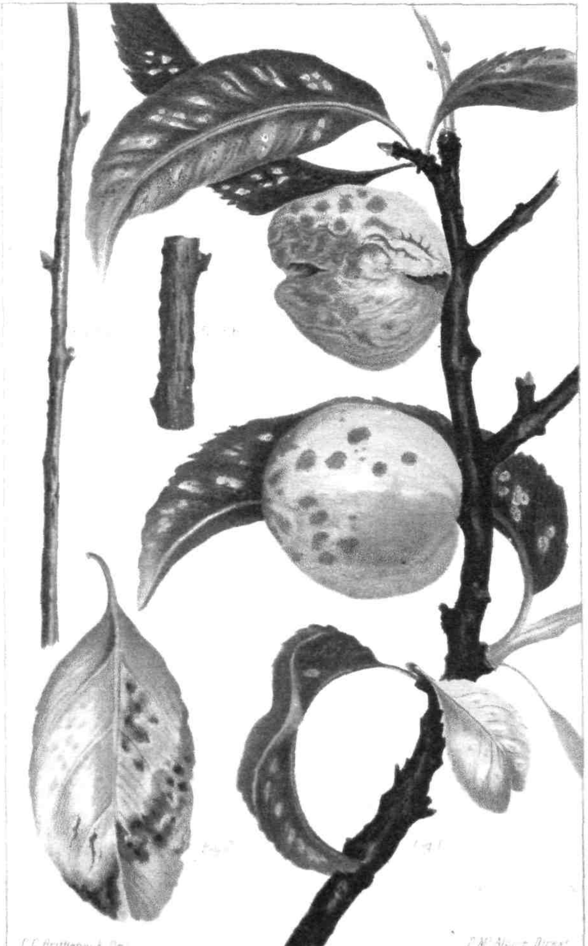
(Puccinia pruni).

Fig. 1.—Fruiting shoot of Lady Palmerston peach with rust on leaves and fruit.

Fig. 2.—Under surface of plum leaf, showing blister-like pustules of rust towards left-hand corner.

Fig. 3 (*a* and *b*).—Twig covered with rust pustules (*b* enlarged)

Plate I



THE VEGETABLE PATHOLOGIST'S BRANCH.

DISEASES OF PLANTS AND THEIR REMEDIES.

By D. McAlpine.

III. Peach and Plum Rust.

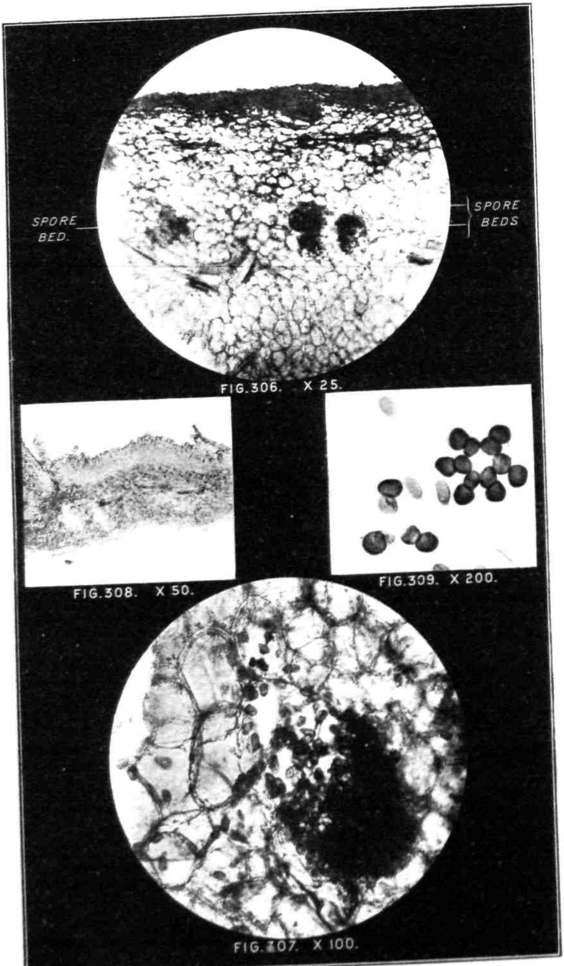
(*Puccinia pruni.*)

This rust is of great economic importance, since it attacks such valuable fruit trees as the peach and nectarine, plum and apricot, cherry and almond, causing them prematurely to shed their leaves, and as a consequence either to bear no fruit or only small quantities of an inferior kind, and the wood formed is not firm enough to resist frost. As the peach tree, for instance, forms its fruit on the previous season's wood, it is evident that the succeeding crop will be affected as well, hence the necessity for attending to the earliest indications of the fungus. It is known wherever stone fruit trees are cultivated, and yet it is sometimes confounded with very different things, just as growers sometimes mistake "bitter pit" for "black spot" of the apple. It is very commonly called "peach yellows" in Australia, on account of the yellow blotches or freckles on the upper surface of the leaf, but it has no connexion with this dreaded American disease, which is now believed to be due to bacteria. The fungus thrives well in our genial climate, and does not confine itself to the leaf, but even attacks the stem and branches, at least of young seedlings, and is now becoming a serious enemy to the peach fruit itself. (Pl. I., Fig. 1. Pl. II., Figs. 306, 307.)

It has been found on all the stone fruit trees grown here with the exception of the cherry. It is most prevalent on the plum and peach, and not so common as yet on the apricot and almond. Although found in other countries on the cherry, it has not yet come under my notice.

TIME AND CONDITION OF OCCURRENCE.

The time of its first appearance varies in different seasons, and the later it is the less damage it does. Generally the spores are plentifully produced about the beginning of the year, and the leaves have usually all dropped off by April. The disease also seems to be intermittent in its character, according to the prevailing weather, and while moisture in the early spring or in the middle of summer encourages the fungus, other conditions, such as accompanying heat or cold, or the amount of moisture in the air, likewise influence it.



G. H. Robinson, Photos.

PEACH AND PLUM RUST.

In April the leaves of plum trees are generally dusted over with the dark-brown winter spores (Fig. 309), and only an occasional summer spore is met with in the same cluster. The falling leaves carry these spores to the ground or they are wafted to the buds and branches, and there they remain during the winter, ready to germinate when favorable conditions arise.

It is remarkable that, while the winter spores are so plentiful on the plum, they are scarce on the almond, and comparatively rare on the apricot and peach. The life history of the fungus thus briefly sketched will guide us in devising measures for preventing its appearance.

TREATMENT.

Since the fungus may occur on the stem and fruit as well as on the leaf it will be necessary to remove and destroy all affected parts, so that no decaying litter left about the orchard may harbor the spores. In addition to all those measures which are necessary for the proper development and healthy growth of the tree, the following should be employed :—

1. Remove and burn all affected parts, in order that the spores for next season may be destroyed as far as possible.

2. Spray with Bordeaux Mixture, so that not only the spores may be destroyed or rendered harmless, but that the tree may be able to resist infection. The spraying should be thoroughly done just when the buds are bursting, for at this season the spores are preparing to germinate, and then they are most easily acted on.

When the yellow spots or blotches appear on the surface of the leaves it is then too late to spray, for this is an indication that the fungus has done its deadly work, and has either reproduced itself or is preparing to do so.

PLATE II.

Fig. 306.—Section of peach fruit attacked by the rust fungus, showing three Red rust spore beds deeply immersed in the tissue. (× 25.)

Fig. 307.—Part of same section showing the spores produced within the tissues of the fruit. This spore bed is the one on extreme right of previous figure. (× 100.)

Fig. 308.—Section of peach leaf showing Red or Summer rust spore bed on under surface. (× 50.)

Fig. 309.—One-celled Red rust and two-celled Black or Winter rust spores from a single spore bed on plum leaf. (× 200.)

EXPERIMENTS IN THE TREATMENT OF BLACK SPOT OF THE APPLE AND PEAR, SEASON 1901-2.

By D. McAlpine.

While many orchardists in the State have been in the habit for many years of spraying for "Black Spot," the great majority were not seized with the necessity of so doing, and as a consequence suffered severe losses in the past season, which was particularly favorable for the development of the disease. It was fortunate, therefore, that the Department had undertaken to carry out a series of experiments in important fruit-growing centres, and was able by this means to demonstrate conclusively the value of spraying. As the result of the severe tests to which the sprays were subject, the Black Spot can no longer be classed as an evil to be endured, but rather as a disease that can be almost entirely prevented. Hence the cloud of depression, which settled down on many when they saw their trees apparently ruined and the fruit upon them generally reduced to a few utterly unmarketable specimens, certainly had its silver lining in the fact that where trees had been properly sprayed there was an abundance of clean and healthy fruit.

General Scope of the Experiments.

Three well-known apple-growing centres were selected for experimental purposes, where Black Spot was known to be prevalent in seasons favorable to its development, and orchards were chosen in these districts containing varieties especially liable to the disease.

Mr. A. F. Thiele at Doncaster, Mr. Warren at Somerville, and Mr. Grant at Pakenham, kindly placed plots at my disposal, and rendered valuable assistance in bringing the experiments to a successful issue; and to these gentlemen my sincere thanks are due and tendered. In each place Mr. Grant's mixture was tried along with other sprays and applied at about the same time, and the relative value of each treatment was shown by contrast with each other and with an unsprayed plot. At Doncaster and Pakenham the plots contained three trees each in rows alongside each other, but at Somerville only two trees were obtainable for each.

In all cases only one application was made, as it was recognised that the cost of the work should be reduced to the lowest possible point.

YATES APPLE AT PAKENHAM

(Sprayed with Bordeaux Mixture, 6·4·50).

The following table shows the composition and cost of the various sprays employed :—

TABLE I.—COMPOSITION AND COST OF SPRAYS.

Plot.	Spray used.	Formulæ for 50 gallons Spray.	Cost per 50 gals.
		SOMERVILLE.	s. d.
1	Bordeaux + Linseed Oil ...	Bluestone, 6 lbs.; lime, 10 lbs.; oil, 6 oz.	1 8
2	Bordeaux + Salammoniac ...	Bluestone, 8 lbs; lime, 8 lbs.; salammoniac, 1½ lbs.	2 8
3	Grant's Mixture	... ...	—
4	Check—Not sprayed	... ...	—
5	Bordeaux + Nitric Acid ...	Bluestone, 6 lbs.; lime, 8 lbs.; nitric acid, 10 oz.	2 0
6	Bordeaux + Alum and Salt ...	Bluestone, 6 lbs; lime, 8 lbs.; alum, 4 lbs; salt, 4 lbs.	2 11
7	Copper-Soda + Oil	Bluestone, 6 lbs.; washing soda, 6 lbs.; oil, 6 oz.	1 9
8	Bordeaux	Bluestone, 8 lbs.; lime, 8 lbs. ...	1 11
		DONCASTER.	
1	Bordeaux	Bluestone, 10 lbs.; lime, 10 lbs. ...	2 5
2	Grant's	... ...	—
3	Bordeaux + Molasses ...	Bluestone, 10 lbs.; lime, 10 lbs.; molasses, 10 lbs.	3 2
4	Check—Not sprayed	... ...	—
5	Copper Acetate + Glue ...	Copper acetate, 2 lbs.; glue, 1 lb. ...	4 0 approx
6	Bluestone + Resin	Bluestone, 4 lbs; resin mixture, 1 gallon	1 6
		PAKENHAM.	
1	Bordeaux	Bluestone, 10 lbs.; lime, 10 lbs. ...	2 5
2	Bordeaux + Molasses ...	Bluestone, 10 lbs.; lime, 10 lbs.; molasses, 10 lbs.	3 2
2A	Grant's	... ...	—
3	Bordeaux	Bluestone, 6 lbs.; lime, 4 lbs. ...	1 5
4	Bordeaux + Salt	Bluestone, 6 lbs.; lime, 4 lbs.; salt, 3 lbs.	1 7
5	Bordeaux + Caustic Soda ...	Bluestone, 6 lbs.; lime, 3 lbs; c. soda, 1 lb.	2 0
6	Bordeaux + Washing Soda ...	Bluestone, 6 lbs.; lime, 3 lbs.; w. soda, 3 lbs.	1 7
6A	Check—Not sprayed	... ...	—
7	Bordeaux + Permanganate of Potash	Bluestone, 4 lbs; lime, 4 lbs.; perm. pot. 1 lb.	1 9
8	Bordeaux + Linseed Oil ...	Bluestone, 6 lbs; lime, 4 lbs.; oil, 3 oz.	1 6
9	Copper-Soda	Bluestone, 6 lbs; washing soda, 6 lbs.	1 8
10	Copper-Soda + Molasses ...	Bluestone, 6 lbs.; washing soda, 6 lbs.; molasses, 1 lb.	1 9
11	Bluestone + Soft Soap ...	Bluestone, 2 lbs.; soft soap, 4 lbs. ...	0 10
12	Copper Acetate + Soft Soap ...	Copper acetate, 1 lb.; soft soap, 1 lb....	1 10
13	Permanganate of Potash + Soft Soap	Perm. potash, 2 lbs.; soft soap, 2 lbs....	1 8
14	Permanganate of Potash + Lime	Perm. potash, 2 lbs.; lime, 10 lbs. ...	1 9
15	Bordeaux	Bluestone, 6 lbs.; lime, 8 lbs. ...	1 6
16	Bordeaux	Bluestone, 6 lbs.; lime, 12 lbs. ...	1 7

NOTE.—The cost of sprays used is based on the Melbourne cost of the ingredients Some of these are subject to considerable fluctuations. Present prices :—

Bluestone ...	25s. cwt.	Lime	2s. 3d. cwt.
Salammoniac ...	6d. lb.	Potash Permanganate	9d. lb.
Washing Soda ...	6s. cwt.	Molasses	7s. 6d. cwt
Copper Acetate ...	1s. 9d. lb.	Soft Soap	1d. to 2d. lb.

In stating the composition of a Bordeaux Mixture, it is usual to give first the quantity of bluestone in lbs., then the lime in lbs., followed by the water in gallons. Accepting this as a basis, we have at hand a most convenient method of concisely expressing the various formulæ. Thus a Bordeaux Mixture composed of 6 lbs. bluestone, 4 lbs. lime, and 50 gallons water, becomes Bordeaux (6·4·50.) When additions of other ingredients are made, as for instance 4 lbs. molasses, then Bordeaux and molasses (6·4·50 + 4) clearly conveys the meaning intended.

The same method may be employed for copper-soda mixtures, remembering always that the second figure represents washing soda, which is used in the place of the lime in Bordeaux.

Method of Estimating Results.

This question had to be carefully considered, and it was finally decided to weigh the fruit from each plot and sort into three grades—firsts, or absolutely clean; seconds, slightly spotted but well worth marketing; and a third class for the badly diseased or not marketable. Speaking generally, the more efficient the mixture as expressed in percentages of clean fruit, the higher the quality of the seconds. The percentage by weight of absolutely clean and of marketable fruit thus obtained was to be the measure of the efficacy of the spray. It seemed rather fastidious at times to class an apple as second quality when only one solitary speck of disease—no bigger than a pin point—was present, yet as all were treated alike the comparison was quite fair.

The Somerville Experiments.

There were eight experimental plots here, consisting of two trees each of the Sturmer Pippin, as nearly as possible equal in age, vigour and size. The trees were about fifteen years old, and in good bearing, some of them yielding nine to ten cases of fruit in 1900. The soil was of the nature of black sand, fairly well drained, and was manured each year with desiccated night-soil, at the rate of 12 cwt. per acre, but no manure was applied to the experimental plots last season.

Spraying was done on the 23rd September, just when the blossom-buds were on the point of bursting, and Mr. Grant applied his mixture two days later—on the 25th. The following daily record of the rainfall from 21st to 30th September, always taken for each date at 9 a.m., shows that showery weather prevailed at that particular time:—

September	21	·17 in.
"	22	·26 "
"	23	·04 "
"	24	·13 "
"	25	·03 "
"	26	·10 "
"	27	nil
"	28	nil
"	29	·24 "
"	30	·37 "

Since one of the plots was left unsprayed as a check, and another treated with Grant's mixture, there were only six treated by myself, and of these, four had special mixtures applied which were not tried in any of the other districts. It is not necessary to give the details here, as these are shown in Table I., but it may be stated generally that Bordeaux mixture was the basis, with the addition of linseed oil, salammoniac, nitric acid, alum and salt respectively, while in one instance bluestone and washing soda were used instead of bluestone and lime.

Unfortunately, the results here are not quite comparable with those at Doncaster and Pakenham, because the fruit was graded on a system recognised as faulty as soon as finished. Mr. A. F. Thiele attended at the picking and sorting of the fruit, as the representative of the Central Fruit-growers' Association, along with Mr. Warren, and they, as practical men, agreed to include the apples affected by codlin moth among the unmarketable, irrespective of the presence or absence of black spot. The idea put forward was, that the trees were about equally effected by the moth, and therefore it would be fair to reject such apples in every case. But since the only object of the experiments was to determine the comparative efficacy of the various sprays against the fungus, this method was misleading, and all grub-eaten apples of fine quality should have been included among the first grade if unaffected by the spot.

TABLE II.—Showing Yield and Condition of Fruit at Somerville.

	Plot.	Marketable Fruit in lbs. Firsts.		Seconds.		Total.		Unmarketable. Lbs.		Gross Yield. Lbs.		Per cent. Marketable.	Per cent. Firsts.
Bordeaux and Oil.	1. Tree A ...	68	...	59	...	127	...	15	...	142	...	...	...
	〃 B ...	65	...	56	...	121	...	16	...	137	...	...	...
	Total ...	...	**133**	...	**115**	...	**248**	...	**31**	...	**279**	**89**	**47**
Bordeaux and Salammoniac.	2. Tree A ...	62	...	24	...	86	...	6	...	92	...	...	...
	〃 B ...	73	...	32	...	105	...	3	...	108	...	...	...
	Total ...	...	**135**	...	**56**	...	**191**	...	**9**	...	**200**	**95**	**67**
Grant's Mixture.	3. Tree A ...	114	...	16	...	130	...	19	...	149	...	...	...
	〃 B ...	79	...	11	...	90	...	5	...	95	...	...	...
	Total ...	...	**193**	...	**27**	...	**220**	...	**24**	...	**244**	**90**	**79**
Check.	4. Tree A ...	10	...	29	...	39	...	26	...	65	...	...	...
	〃 B ...	1	...	4	...	5	...	3½	...	8½	...	...	...
	Total ...	...	**11**	...	**33**	...	**44**	...	**29½**	...	**73½**	**60**	**14**
	5. Total ...	...	**63**	...	**63**	...	**126**	...	**22**	...	**148**	**85**	**42**
	6. Total ...	...	**22**	...	**50**	...	**72**	...	**26**	...	**98**	**73**	**22**

TABLE II.—Showing Yield and Condition of Fruit at Somerville—*continued.*

	Plot.		Marketable Fruits in lbs.						Unmarketable		Gross Yield.		Per cent. Marketable.	Per cent. Firsts.
			Firsts.		Seconds.		Total.		Lbs.		Lbs.			
Copper-Soda, and Oil.	7. Tree A	...	29	...	37	...	66	...	11	...	77	...	...	...
	" B	...	38	...	19	...	57	...	8	...	65	...	...	...
	Total	...	...	**67**	...	**56**	...	**123**	...	**19**	...	**142**	**87**	**47**
Bordeaux.	8. Tree A	...	74	...	36	...	110	...	16	...	126	...	...	...
	" B	...	91	...	40	...	131	...	12	...	143	...	...	...
	Total	...	...	**165**	...	**76**	...	**241**	...	**28**	...	**269**	**89**	**61**

NOTE.—(*a*) Only 20 apples rendered unmarketable by the fungus in plot 2, only 13 in plot 3, and 12 in plot 7. (*b*) In plots 5 and 6 only totals given of the two trees in plot.

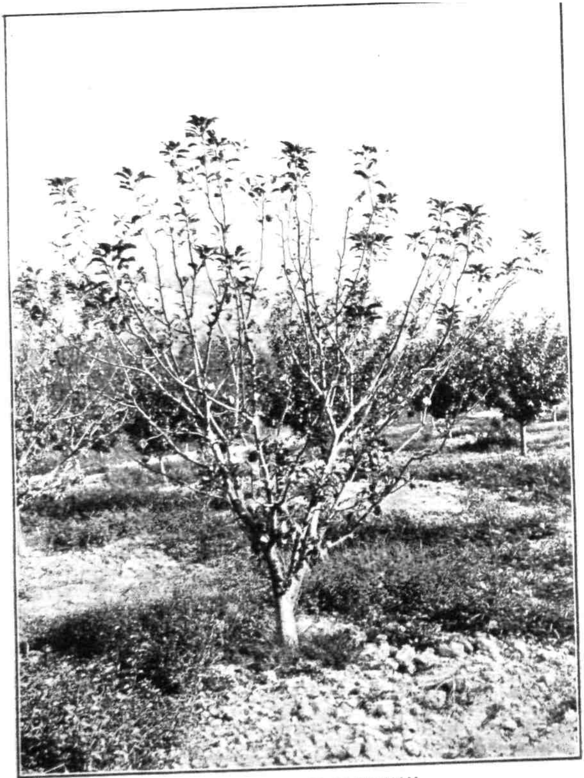
It will be seen from the preceding table that the highest percentage of first-quality fruit was 79 from Mr. Grant's plot, then 67 from Bordeaux and salammoniac (8·8·50 + 1½), next 61 from Bordeaux (8·8·50), and fourth, 47 from Bordeaux and oil (6·10·50 + 6 oz.).

In yield of marketable fruit the last-named was first with 248 lbs., Bordeaux (8·8·50) second with 241 lbs., Mr. Grant's third with 220 lbs., and then Bordeaux and salammoniac with 191 lbs. As against these figures, the return from the Check plot, 44 lbs. of marketable fruit, with a percentage of 14 first grade, furnishes a striking testimony to the value of each and all of these sprays.

The Doncaster Experiments.

In this case the Yates apple, notorious for its liability to spot, was selected. Though some trees of Munro's Favourite apple and Williams' Bon Chretien pear were also sprayed, the setting of their fruit was so irregular that it was judged wiser to neglect them, especially as no marked results were obtained. In the Yates there were six plots of three trees each, all splendid trees ten years old and in full vigour. Spraying was done by me on 12th September, just as the blossom buds began to expand, and Mr. Grant applied his mixture two days later. Bordeaux mixture, Bordeaux mixture with molasses, Copper sulphate, and also Copper-acetate were employed in these tests.

The results are given in Table III., and show that the highest percentage of marketable fruit, 99¾ per cent., was obtained from Mr. Grant's plot, while Bordeaux (10·10·50) and Bordeaux with molasses (10·10·50 + 10) gave 98½ per cent. each. In the absolutely clean fruit, however, Mr. Grant's mixture was easily first, with 64 per cent., while the other two gave 33 per cent. and 37 per cent. respectively. The unsprayed plot, with only one-sixth to one-eighth of the total yield of the best three sprayed plots, gave 55 per cent. marketable, but only a single apple absolutely clean. In these experiments the trees suffered rather severely from the dryness of the late summer and early autumn.



YATES APPLE AT PAKENHAM

(Not Sprayed.)

TABLE III.—Showing Yield and Condition of Fruit at Doncaster.

	Plot.	Marketable Fruits in lbs.						Unmarketable. Badly Spotted.		Gross Yield.		Per cent. Marketable.	Per cent. Absolutely Clean.
		Absolutely Clean.		Slightly Spotted.		Total.		Lbs.		Lbs.			
Bordeaux.	1. Tree A	14	...	51	...	65	...	3	...	68	...	...	...
	" B	28	...	40	...	68	...	¾	...	68¾	...	...	...
	" C	57	...	106	...	163	...	¾	...	163¾	...	...	...
	Total...	...	**99**	...	**197**	...	**296**	...	**4½**	...	**300½**	**98½**	**33**
Grant's Mixture.	2. Tree A	7	...	20	...	27	...	2 apples	...	27	...	...	...
	" B	77½	...	51	...	128½	...	½	...	129	...	...	...
	" C	101	...	33	...	134	...	2 apples	...	134	...	...	...
	Total...	...	**185½**	...	**104**	...	**289½**	...	**¾**	...	**290¼**	**99¾**	**64**
Bordeaux + Molasses.	3. Tree A	28½	...	68	...	96½	...	1	...	97½	...	...	...
	" B	75¼	...	149¾	...	225	...	4	...	229	...	...	...
	" C	73	...	68	...	141	...	1¾	...	142¾	...	...	...
	Total...	...	**176¾**	...	**285¾**	...	**462½**	...	**6¾**	...	**469¼**	**98½**	**37**
Check.	4. Tree A	1 apple	...	13	...	13	...	9	...	22	...	...	...
	" B	0	...	17	...	17	...	13	...	30	...	...	...
	" C	0	...	¾	...	¾	...	2½	...	3¼	...	...	...
	Total...	...	**1 apple**	...	**30¾**	...	**30¾**	..	**24½**	...	**55¼**	**65**	**0**
	5. (3 trees)	...	**1¾**	...	**151¼**	...	**153**	...	**57¾**	...	**210¾**	**72**	nearly **1**
	6. (3 trees)	...	**3½**	...	**150½**	...	**154**	...	**27**	...	**181**	**85**	**2**

NOTE.—*Three trees in all plots, but only totals given in plots 5 and 6.*

The Pakenham Experiments.

These were the most numerous and instructive of the series, there being no fewer than eighteen plots of Yates apple, while the season and situation were specially suited for a test of the efficacy of the sprays. The spraying took place on 19th and 20th of September, when the blossom buds had burst, but before the opening of the individual flowers. Mr. Grant's mixture was applied on the 20th, and on both occasions the weather was showery, but especially so on the first day, when frequent adjournments were rendered necessary; and plots 1, 2, and 3, which were done then, scarcely received the same chance as the others. The average rainfall for the district is 33·3 inches, and the fall occurring at about the spraying time is given below, from which it will be seen that the test was a most severe one—

18th September ...	·25 in.	23rd September ...	·35 in.
19th " ...	·25 "	24th " ...	·32 "
21st " ...	·35 "	25th " ...	·68 "

TABLE IV.—Showing Yield and Condition of Fruit at Pakenham.

	Plot.	Marketable Fruit in lbs. — Absolutely Clean.		Marketable Fruit in lbs. — Slightly Spotted.		Marketable Fruit in lbs. — Total.		Unmarketable—Badly Spotted. lbs.		Gross Yield. lbs.		Per cent. Marketable.	Per cent Absolutely Clean.
Bordeaux.	1. Tree A ...	5	...	5½	...	10½	...	0	...	10½	...	...	...
	" B ...	13½	...	12½	...	26	...	0	...	26	...	...	...
	" C ...	15¼	...	2	...	17¼	...	¼	...	17½	...	...	...
	Total ...	...	**33¾**	...	**20**	...	**53¾**	...	¼	...	**54**	**99½**	**62**
Bordeaux + Molasses.	2. Tree A ...	36	...	30½	...	66½	...	¼	...	66¾	...	...	...
	" B ...	13½	...	18	...	31½	...	0	...	31½	...	...	...
	" C ...	8	...	3¼	...	11¼	...	0	...	11¼	...	...	...
	Total ...	...	**57½**	...	**51¾**	...	**109¼**	...	¼	...	**109½**	**99¾**	**52**
Grant's Mixture.	2A. Tree A ...	47	...	13	...	60	...	0	...	60	...	...	...
	" B ...	95¼	...	11	...	106¼	...	0	...	106¼	...	...	...
	" C ...	36½	...	4	...	40½	...	0	...	40½	...	...	...
	Total ...	...	**178¾**	...	**28**	...	**206¾**	...	**0**	...	**206¾**	**100**	**86**
Bordeaux.	3. Tree A ...	20½	...	14	...	34½	...	0	...	34½	...	...	...
	" B ...	14	...	12½	...	26½	...	0	...	26½	...	...	...
	" C ...	26½	...	19¾	...	46¼	...	0	...	46¼	...	...	...
	Total ...	...	**61**	...	**46¼**	...	**107¼**	...	**0**	...	**107¼**	**100**	**57**
Bordeaux + Salt.	4. Tree A ...	10¾	...	3	...	13¾	...	0	...	13¾	...	...	...
	" B ...	29¼	...	17½	...	46¾	...	0	...	46¾	...	...	...
	" C ...	27½	...	12½	...	40.	...	0	...	40	...	...	...
	Total ...	...	**67½**	...	**33**	...	**100½**	...	**0**	...	**100½**	**100**	**67**
	5. Total ...	...	**54½**	...	**86½**	...	**141**	...	¼	...	**141¼**	**99¾**	**38**
	6. Total ...	...	**34¾**	...	**104¼**	...	**139**	...	**1½**	...	**140½**	**99**	**24**
Check.	6A. Tree A ...	0	...	6	...	6	...	7	...	13	...	...	...
	" B ...	0	...	1½	...	1½	...	¼	...	1¾	...	...	...
	" C ...	0	...	0	...	0	...	¼	...	¼	...	...	...
	Total ...	...	**0**	...	**7½**	...	**7½**	...	**7½**	...	**15**	**50**	**0**
	7. Total ...	...	**24¾**	...	**118½**	...	**143¼**	...	**4**	...	**147¼**	**97**	**16**
	8. Total ...	...	**25**	...	**69¼**	...	**94¼**	...	½	...	**94¾**	**99**	**26**
	9. Total ...	...	**12¼**	...	**13¾**	...	**26**	...	**0**	...	**26**	**100**	**48**
	10. Total ...	...	**37**	...	**69¾**	...	**106¾**	...	¼	...	**107**	**99¾**	**34**

TABLE IV.—Showing Yield and Condition of Fruit at Pakenham—*continued.*

Plot.	Marketable Fruit in lbs.			Unmarketable—Badly Spotted. lbs.	Gross Yield. lbs.	Per cent. Marketable.	Per cent. Absolutely Clean.
	Absolutely Clean.	Slightly Spotted.	Total.				
11. Total	37	56	93	0	93	100	40
12. Total	8¾	77½	86¼	2¾	89	97	10
13. Total	0	36	36	19½	55½	65	0
14. Total	0	56	5	23½	79½	70	0
15. Total	20½	90	110½	3¼	113¾	97	18
16. Total	28¾	182¾	211½	20	231½	91	12

NOTE.—Three trees in all plots but in Nos. 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, and 16 totals only given.

The unsprayed trees were almost entirely leafless at picking time, and presented a striking contrast to those sprayed with the various forms of Bordeaux or Copper-Soda, which were covered with healthy green foliage. The unsprayed plot produced the insignificant yield of 15 lbs., average 5 lbs. per tree, of which a total of 7 lbs. only was marketable; that is 50 per cent., but none of the fruit was absolutely clean. Mr. Grant's plot gave the handsome return of 206¾ lbs., all of which was marketable, and 86 per cent. perfectly free from spot. The plot sprayed with Bordeaux mixture with salt (6·4·50+3) was next with 100½ lbs., and 100 per cent. marketable fruit, of which 67 per cent. was absolutely spotless. Taking the percentage of spotless fruit as the index to the value of the sprays, the following is the order of merit of those returning 50 per cent. or over :—

TABLE V.—Order of merit of Pakenham Sprays.

Plot.	—	Per cent. Spotless.	Per cent. Marketable.	Yield of Marketable, in lbs.
2A	Grant's mixture	86	100	206¾
4	Bordeaux and salt (6·4·50+3) ...	67	100	100¼
1	Bordeaux (10·10·50)	62	99½	54
3	Bordeaux (6·4·50)	57	100	107½
2	Bordeaux and molasses (10·10·50+10)	52	99¾	109¼

Comparative Results of the Somerville-Doncaster-Pakenham Experiments.

Bearing in mind the nature of the past season, and the fact that the varieties experimented upon were specially liable to Black Spot, it is evident, from the tabulated results already given, that the efficacy of one spraying with Bordeaux mixture in combating the disease is beyond dispute, hence the great practical value of the experiments. Yet, in discussing and comparing the results obtained in a single year, it must be remembered that a longer period of trial is necessary to arrive at just conclusions, and that field experiments are at best only approximately correct. If the trees in each plot were of equal size and vigour, and, other things being equal, would produce the same amount of fruit, then the relative influence of the various sprays could be determined, not alone as regards their efficiency in checking disease, but also as to their influence on the setting of the fruit. *We know* that on the unsprayed plots, and on some of those sprayed with inefficient mixtures, the setting was poor, and much of what did set, later on fell off, but *what we do not know* is which of the effectual mixtures was most beneficial or least injurious to the setting. Thus, at Somerville the Bordeaux and linseed oil gave the highest yield of marketable fruit —248 lbs.—then a Bordeaux (8·8·50) followed with 241 lbs., and third on the list was Mr. Grant's, with 220 lbs. Much the same occurred at Doncaster, where Bordeaux and molasses was far in advance of the others, with 462 lbs. as against 296 lbs. for Bordeaux without molasses, and 289 lbs. for Mr. Grant's mixture. These results, however, were quite reversed at Pakenham, where Mr. Grant's plot was easily first among the more efficient mixtures, with 206¾ lbs., as against 109, 107, 100, and 53 for each of four forms of Bordeaux, though plot 16 gave the heaviest yield of all, but the trees were much larger and more vigorous. The varied yields in all these instances must be put down to the individual character and conditions of the trees, and do not seem to be in any way connected with the sprays.

The following table gives, in a condensed form, the results of the best sprays in each locality as regards the prevention of the spot :—

TABLE VI.—The Most Successful Sprays.

Locality.	Spray.	Per cent. Marketable.	Per cent. Clean.
Somerville* ...	Grant's	90	79
" ...	Bordeaux and salammoniac (8·8·50 + 1½) ...	95	67
Doncaster ...	Grant's	99¾	64
" ...	Bordeaux and molasses (10·10·50 + 10) ...	98½	37
Pakenham ...	Grant's	100	86
" ...	Bordeaux and salt (6·4·50 + 3)	100	67

* Somerville grading of fruit different to others, as previously stated.

From this it will be seen that Mr. Grant's mixture was more effective than any other form of Bordeaux mixture in preventing the Black Spot, and the very high percentage of absolutely clean fruit clearly demonstrates its remarkable value.

YATES APPLE AT PAKENHAM

(Sprayed with Mr. Grant's Mixture).

Future Work.

Successful as these experiments have been, it must not be thought that the work is completed. On the contrary, it has only begun. A promising field for research lies open in the determination of the relative effects of sprays applied at different times. It is probable that the particularly favorable results this year as contrasted with those of last year are due to the later period at which the treatment was applied. Also, it is obvious that if the same or better results could be obtained from spraying, say, two or three weeks earlier; the value of the mixture enabling this to be done would be much greater than that of a mixture which must be applied just before the flowers expand.

Again, the remarkable success of Mr. Grant's mixture, which is composed of bluestone and lime, with some added ingredient, and made in the same way as Bordeaux, indicates that certain substances can with advantage be added to the latter. It is a well-known principle in chemistry that the toxic (*i.e.*, poisonous) properties of solutions of certain salts are often increased by the addition of a certain proportion of some other salt. In our own experiments it was found that salammoniac (chloride of ammonium) had this effect. This, however, costs 6d. per lb., but the same or better results might be obtained from sulphate of ammonia at 2d. or less per lb. Again, Mr. Hatfield's mixture, which is also Bordeaux with something else, in his experiments gave better results than plain Bordeaux. At Pakenham, too, it was found that common salt (chloride of sodium) distinctly increased the efficiency of the Bordeaux when added at the rate of 3 lbs. in 50 gallons. Smaller quantities of this might be tried as well as other sodium salts such as nitrate of soda. Although potassium permanganate apparently reduced the efficiency of the Bordeaux to which it was added at the rate of 25 per cent. of the quantity of bluestone, it by no means follows that a smaller amount would give the same result, nor that other salts of potassium, as saltpetre (nitrate of potassium) would not prove more efficacious.

The *Revue de Viticulture* of France has at various times contained references to the addition of different substances to Bordeaux, among them being included corrosive sublimate, a salt of mercury, in itself highly poisonous. It has been asserted by some experimenters that the results from its use have been entirely satisfactory.

The method of preparing Bordeaux mixture has much to do with its efficiency, but as this article has already reached undue proportions, the consideration of methods of manufacture, mode and time of application must be deferred till next issue. In the meantime, growers are advised not to commence their spraying till the buds begin to swell.

* * * * * *

Some Experiments by Individual Growers.

Mr. Godfrey at Croydon.

In the orchard of Mr. Owen Dabb, at Croydon, an experiment was conducted by Mr. Godfrey with his mixture, also understood to be a modification of Bordeaux.

The variety selected was Rokewood, very liable to Black Spot, and the spraying was done on 27th September, when the blossoms were open. The weather was dry then, no rain falling for nearly a fortnight. The average rainfall for the district is 30 inches. The results are appended :—

TABLE VII.—Yield in lbs. and condition of fruit at Croydon.

Tree.	Absolutely Clean.		Slightly Spotted.		Total Marketable.		Not Marketable.		Gross Yield.		Per cent. Marketable.	Per cent. Clean.
Sprayed A ...	29½	...	40¾	...	70¼	...	0	...	70¼	...	...	...
" B ...	10¾	...	25¼	...	36	...	½	...	36½	...	...	...
Total ...	...	**40¼**	...	**66**	...	**106¼**	...	½	...	**106¾**	**98½**	**37½**
Not sprayed C	...	**0**	...	**0**	...	**0**	...	**5½**	...	**5½**	**0**	**0**

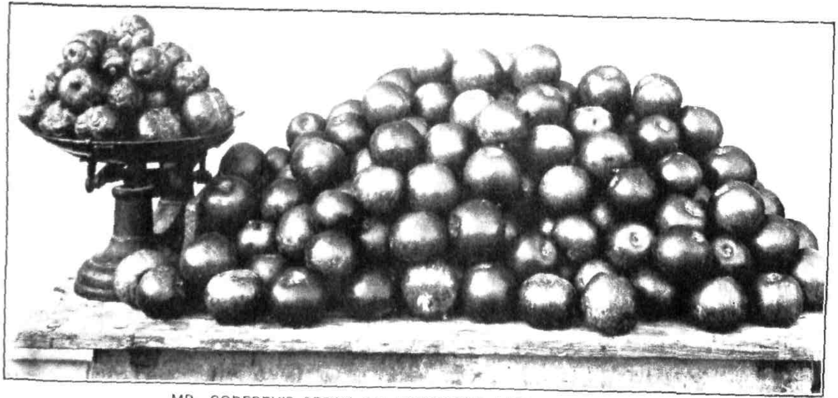
MR. GRANT AT PAKENHAM.

Another formula of Mr. Grant's was applied to Yates trees alongside the experimental plots at Pakenham. The results obtained were remarkable, as from 90 to 94 per cent. of the fruit was absolutely clean on the three trees picked for testing. This is as near perfection as possible.

TABLE VIII.

—	Absolutely *Clean.*	Slightly *Spotted.*	Total Yield.	Per cent. Marketable.	Per cent. Clean.
	lbs.	lbs.			
Tree A	56	5½	61½	100	91
" B	95½	5¼	100¾	100	94
" C	96¼	10¾	107	100	90

These results are of first importance, and suggest the desirability of selecting a plot of trees of the Yates or some badly spotting variety, as nearly equal as possible, during the forthcoming season, and testing alongside of each other the sprays employed by various growers, as well as Bordeaux and Copper-soda Mixtures with various additions. As far as Copper-soda is concerned, I see no reason why its efficiency should not be so much increased as to become fully equal to the best form of Bordeaux Mixture, and this should prove a great boon to fruit-growers in districts where good fresh lime is not easily and cheaply procurable.



MR. GODFREY'S SPRAY ON ROKEWOOD APPLE AT CROYDON.

	lbs.
Yield on Unsprayed Tree	
Absolutely Clean	
Marketable ..	—
Not Marketable	5¼
Total	5¼

	lbs.
Yield of Sprayed Tree	
Absolutely Clean	29½
Marketable	40¾
Not Marketable	0½
Total	70¾

"DIE BACK" OF THE APPLE.

It will be remembered that, two or three years ago, considerable publicity was given in the press to the disease known as "Die Back" in apples, which was particularly destructive in the young orchards at Pomona, near Stawell. Several experts of the Department visited the scene of the trouble on different occasions, but no definite decision was made beyond that insects, such as root borer, were not responsible, but the soil itself was regarded as being in some way connected with the disease. A chemical analysis of the soil was made by Mr. Pearson, without revealing the presence of any constituent which could in any way be regarded as accountable.

Some eighteen months ago the Vegetable Pathologist and his assistant inspected several orchards at Pomona, in response to a desire expressed by Mr. Wettenhall, of Glen Holford, who has a considerable area there under apples. A careful examination was then made of numerous diseased trees, and in the majority of cases the thick black cord-like strands or rhizomorphs of the Honey Agaric (*Armillaria mellea*) were found attached to the roots and the lower underground portions of the trunk. In a few instances these were not observed, and consequently Mr. Wettenhall was not prepared to accept the view put forward by the Pathologist that this fungus was the primary cause of the trouble.

Quite recently, however, a letter was received from Mr. Wettenhall in which he stated that he had found in plenty the mushroom-like fructification of the fungus, and also that he was pretty well convinced that the Honey Agaric was the cause of "Die Back." The desire was also expressed that experiments should be carried out by the Pathologist's branch, with a view of discovering some method of affording relief to the attacked trees.

The Honey Agaric is extremely destructive in European vineyards and little success has so far been obtained with remedial measures. From Rutherglen, in this State, it has been found destroying vines and near Shepparton apricot and other trees have been killed by it. The black rhizomorphs are easily recognised, being quite distinct in colour and texture from the roots, and are frequently found in great profusion just below the surface of the ground. At Mordialloc last year an orchard was inspected, in which nearly all the trees were dead or dying. The top foot of the soil near the trees was permeated with the strands of the fungus. Should these strands in the course of their growth meet the roots of any trees, the bark is pierced, and the fungus proceeds to draw its nourishment from this new victim.

AUSTRALIAN HONEY IN ENGLAND.

When the Surrey Beekeepers' Association held its annual show in London last year, Sir Andrew Clarke, the late Agent-General, requested Mr. White, the attendant in charge of the Victorian exhibit at the Crystal Palace, to gather any information likely to prove of value to Victorian apiarists. A report, the salient points of which are here given, was accordingly prepared by Mr. White.

The samples of Victorian honey submitted to the experts at the show were said to possess a peculiar flavour (eucalyptus ?) which was likely to prejudice its sale. To overcome this it was suggested that plenty of "Lime" honey should be mixed with it, but whether it would pay Victorian beekeepers to plant these trees is another question.

The best English honey is that produced from clover and sainfoin, and readily sells at 1s. and 1s. 3d. per lb. retail. To improve both the quality and quantity of the local product, Mr. C. T. Overton, a first-class expert of the British Beekeepers' Association, advised extensive planting of clover and sainfoin. The wholesale prices of English honey are as follows :—

First grade,	in 28-lb. tins—	7d. to 7½d. per lb.
Second do.	do.	6d. per lb.
First	do. in jars ...	10s. per doz.
Second do.	do. ...	8s. do.

The way in which honey is sent forward from Victoria is stated to compare favorably with the methods of other countries. In Mr. White's opinion, a net return of 3d. per lb. could be obtained for our honey if some one at the London end could place it in suitable bottles, and supply the wholesale trade, instead of consigning to brokers as at present.

GENERAL NOTES.

Spaying Cattle.

Mr. David Wilson, the spaying expert attached to the Department has recently been visiting the Bairnsdale district, and reports that th interest taken in the work is much greater than at the time of hi earlier demonstrations. Excellent results have been obtained from the work previously performed, not a single loss having to be recorded It is, therefore, no wonder that the number of beasts spayed on hi recent visit was much greater than usual, farmers and others having gained confidence in the value of the system.

Six practical exhibitions of spaying were given, when 174 beast were so treated, and four demonstrations of castrating horses withou searing, in each instance a large number of people being present.

Preparation of Dried Apricots.

The following report has been received from Mr. J. M. Sinclair, th representative of the Agricultural Department in London :—

"Several tons of South Australian dried apricots, last season's crop, have been sold on the London market at 58s. per cwt. Good Californian realize 62s. per cwt. Those from South Australia ar regarded by the trade as dried too much, and have not the appearanc of those from California, consequently realizing less money. The bulk of those now exported from California appeared to have beer treated to some process of moistening with a glucose preparation afte evaporation, as they are softer and fresher. As it may be of interes to those engaged in the industry, samples of Californian and Sout Australian have been procured and forwarded to the Department. A one time Californian apricots came in the same condition as the Sout Australian, but now all their best dried ones arrive as indicated. The sell better, being fresh looking and attractive, and the grower mus benefit by preparing them in this way, as they weigh heavier. Ther is a duty of 7s. per cwt. on dried apricots, and the Californians pu them up in 25-lb. boxes."

Preservatives in Meat.

Some regulations relating to the addition of preservatives to mea have been issued by the German Government under the powers con ferred by the Meat Inspection Act of 1900. The use of boracic acid an its salts, formaldehyde or formalin, salicylic acid and its compound and certain other substances less commonly employed, is absolutel forbidden in meat prepared for local sale or in that imported. Colourin matter of all kinds is also prohibited, except their use in colourin margarine yellow and in treating sausage skins, so long as they are no forbidden by other existing regulations.

In contrast to this the committee appointed by the Local Gover ment Board in England to inquire into the use of preservatives in foo came to the conclusion that the use of boracic acid and its compoun

in fresh and cured meat, butter, &c., might be permitted in proportion not exceeding 0·5 per cent. expressed as boracic acid. The committee, however, condemned the use of formaldehyde or formalin in foods and drinks, and, while permitting the addition of 1 grain per lb. or pint of salicylic acid in certain cases except milk, cream, butter, and infant's food, recommended that where added its presence should be declared.

Dodder in Lucerne.

An interesting report on methods of destroying dodder in lucerne fields was given by M. Baille, in the *Revue de Viticulture*, 1901, No. 372. The author states that where the pest exists in the paddocks it may be absolutely destroyed by the application of powdered sulphate of iron to the soil, which not only destroys the dodder but also the parts of the lucerne plants above ground.

A much cheaper and effective substitute for the sulphate of iron is the refuse material used for purifying gas at the works. This mixture is said to be composed of 66 lbs. of sulphate of iron, one third of a bushel of quicklime, and half a bushel of sawdust. If such a mixture is employed at any local gas works it could be conveniently used in place of sulphate of iron at very much less cost. Before strewing on the affected patches it should be allowed to stand exposed to the air for some days to permit the escape of the gas absorbed in the process of purification.

A Flattering Opinion.

We recently dropped in at 153 Leadenhall-street, E.C., and had a look at the splendid samples of Victorian produce which Mr. Sinclair had on show. In view of the still greater expansion of this export business, it is desirable that the British trader and consumer should be furnished with some information concerning these productions of Victoria, and of the concerted action being taken by the Government and the producers of it, so as to export no produce but that of the highest quality and standard. It may be safely asserted that no country in the world exercises more careful state supervision over the exportation of its agricultural products or takes greater interest in giving such assistance as will help to raise the standard of them. This is being done with the object of giving consumers in the countries to which they are exported, as far as possible, an absolute guarantee of the quality of these products, and in the case of butter, cheese, wine, and honey, perfect certainty of freedom from adulteration. . . . . . —*Miller.*

Inspection of United States Dairy Exports.

The United States Secretary for Agriculture has, under authorization of Congress, instituted a system of inspecting dairy products intended for export. The plan is to approve, stamp, and certify products found upon inspection to be of such quality and character as to be presumably creditable to the dairy industry of the United States, when placed in foreign markets within a reasonable time from the

date of inspection. Inspectors are expressly directed *not* to inspect or certify to any butter which belongs to the commercial grades known as ladled, factory, process or renovated, or any skimmed or partly skimmed cheese. They are also to exclude lots of butter and cheese, no matter how good in quality, which are in poor packages, or such as are unsuited to the requirements and perils of the export trade. They are instructed to decline to mark or certify to any products which upon their packages or otherwise bear commercial or other marks, labels, or brands which misrepresent the true nature, character, or grade of such products. The Government indorsement will be withheld in any case where it is proposed to export "dairy" or "imitation creamery" butter, although entirely satisfactory in quality and otherwise suitable for export. The inspection is to be for the present, at least, entirely optional with exporters; consequently, existing trade conditions and relations are left wholly undisturbed.

The *Farming World*, of Toronto, thinks that the main purpose of all this is to endeavour to recover to some extent the prestige which the United States has lost through shipping "spurious" dairy products to the Old Land. The Department at Washington has a large task before it in its attempt to retrieve the ground so foolishly lost a decade ago. But persistent efforts along the lines indicated will accomplish much, and it behoves Canadian dairymen to be on the alert, lest their high reputation in the British markets for fine dairy products be lessened by the efforts of their American competitors.—*British Refrigeration.*

EXPORTS BRANCH.

PARTICULARS of Frozen Produce exported from Victoria from 20th April, 1902, to 20th May, 1902.

Description of Produce.		Shipped through Government Cool Stores.	Shipped through other Cool Stores.	Total Quantity Shipped.
Butter (Victorian)	lbs.	233,240	...	951,328
,, (Inter-State and Bond) ...	,,	358,288	359,800	
Cheese	,,	...	4,800	4,800
Milk and Cream (Concentrated) ...	cases	644	21	665
Poultry	head	34,722	8,745	43,467
Eggs	dozen	33,000	...	33,000
Lamb and Mutton	carcasses	426	4,971	5,397
Calves and Pigs	,,	21	59	80
Beef	pieces	...	295	295
Rabbits	pairs	86,913	1,461	88,374
Hares	,,	64	...	64
Sundries	lbs.	6,523	10,899	17,422
Fruit	cases	109	2,625	2,734

R. CROWE,
Dairy Expert.

SUMMARY.

MONTHLY RETURN of Farm Products Exported and Certified to from 21st April to 21st May, 1902.

WAR OFFICE CONTRACTS.

Number.	Products.	Weight. Tons	cwt.	qrs.
57,134 bags ...	Algerian Oats	2,040	10	0
15,999 ,, ...	Flour	1,000	0	0

Private Shipment.

		Approx. weight. Tons	cwt.	qrs.
1,764 bales	Compressed fodder	80	0	0
3,694 cases	Onions	132	0	0
3,752 bags	Potatoes	288	0	0
741 cases	,, ...	25	0	0

New South Wales.

		Tons	cwt.	qrs.
1,651 bags	Potatoes	127	0	0
2,793 ,, ...	Onions	186	0	0
4,451 bales	Hay	200	0	0
1,291 bags	Chaff	50	0	0
650 ,, ...	Oats		—	
201 ,, ...	Barley		—	

Queensland.

		Tons	cwt.	qrs.
1,096 bags	Potatoes	84	0	0
499 ,, ...	Onions	34	0	0
160 ,, ...	Maize		—	

West Australia.

		Tons	cwt.	qrs.
958 bags	Potatoes	74	0	0
564 ,, ...	Onions	38	0	0
114 ,, ...	Oats		—	
5 ,, ...	Wheat		—	

South Australia.

		Tons	cwt.	qrs.
1,353 bags	Potatoes	104	0	0

Tasmania.

		Tons	cwt.	qrs.
166 bags	Onions	12	0	0

J. KNIGHT.

EXPORT OF FRUIT.

Return *showing number of cases of Fruit, Plants, and Bulbs inspected for export to* Australian States, and New Zealand only, for month ending 20th May, 1902 :—

Name of Fruit, &c.	Number of Cases Inspected.	Number of Certificates Given.
Apples	466	61
Bananas	1,070	52
Citrons	2	2
Figs	2	2
Grapes	709	130
Lemons	129	76
Melons	18	10
Oranges	180	80
Passion Fruit	42	29
Peaches	17	6
Pears	358	54
Persimmons	6	6
Pine Apples	88	71
Pomegranates	1	1
Quinces	1,430	43
Tomatoes	22	3
Plants	127	90
Total	4,667	716

Return of Fruit Inspected for Export to ports beyond the Australian Commonwealth, *for Month ending 20th May, 1902* :—

South Africa—	China—	India—
Apples ... 2,833 cases	Apples ... 50 cases	Apples ... 190 cases

J. G. TURNER.

RAINFALL IN VICTORIA.

By P. Baracchi.

MONTH OF APRIL, 1902.

Areas.	Actual Average Rainfall recorded in each Area, in April, 1902.	Average Rainfall for each Area for the Month of April, based on all previous years of record.	Maximum Fall recorded within each Area during April, 1902.
	Inches.	Inches.	Inches.
A	0·05	1·32	0·28 at Tyrrell Downs
B	0·06	1·95	0·30 " Apsley
C	0·27	2·31	0·77 " Koroit
D	0·66	2·89	0·82 " Warrnambool
E	0·07	1·72	0·28 " Swan Hill
F	0·01	2·11	0·05 " Yarrawonga
F1	0·05	2·13	0·16 " Seymour
F2	0·00	2·53	
G	0·11	2·17	0·31 " Kyneton
H	0·21	2·72	0·40 " Daylesford
I	0·57	2·49	1·29 " Grantville
I1	0·95	2·99	1·25 " Dandenong
K	0·86	3·43	1·84 " Leongatha
L	0·70	2·85	1·29 " Cunninghame
M ...	1·16	2·35	1·16 " Gabo

Subdivisional Areas of the State of Victoria, representing typical Distribution of Rainfall.

A. North-west—Mallee country, including the counties of Millewa, Taila, Weeah, and Karkarooc.

B. Central West—Including the counties of Lowan and Borung.

C. Western Districts—Including the counties of Follett, Dundas, western half of Ripon and Hampden.

D. South-western Districts and West Coast—Including the counties of Normanby, Villiers, Heytesbury, and Polwarth.

E. Northern Country.—*Including the counties of Tatchera and Gunbower, and the* northern half of Kara Kara, Gladstone, and Bendigo, and the north-west portions of Rodney and Moira.

F. Northern Country—Including the greater part of the county of Moira, the north-eastern quarter of the county of Rodney, and the extreme north-west of the county of Bogong.

F1. Central North—Including the county of Anglesey, the west and northern parts of the county of Delatite, the extreme south of the county of Moira, and the south-east quarter of Rodney.

F2. Upper Murray—Districts from Wodonga to Towong.

G. Central Districts North of Dividing Ranges—Including counties of Talbot and Dalhousie, southern half of the counties of Kara Kara, Gladstone, and Bendigo, and the south-west quarter of the county of Rodney.

H. Central Highlands and Ranges from Ararat to Kilmore

I. South Central Districts on the west and north side of Port Phillip Bay—Including the counties of Grant, Grenville, and Bourke, and the eastern parts of the counties of Hampden and Ripon.

I1. South Central Districts east of Port Phillip Bay, &c.—Including the counties of Mornington and Evelyn.

K. Regions of Heaviest Rainfall—including all the mountainous Eastern Districts, and South Gippsland.

L. South-eastern Districts—Gippsland, and counties on the New South Wales Border.

M. *Extreme East Coast.*

TABLE SHOWING RAINFALL over the 26 basins or regions constituting the State of Victoria, recorded in the first quarter of the year 1902, together with corresponding averages deduced from all the records of past years.

Name of Basin.	1st Quarter.							
	January.		February.		March.			
	Amount, 1902.	Average.	Amount, 1902.	Average.	Amount, 1902.	Average.	Total for 1st Quarter.	Average for 1st Quarter.
Glenelg and Wannon Rivers ...	0·98	1·44	1·15	0·62	1·14	1·32	3·27	3·38
Fitzroy, Eumerella, and Merrie Rivers	1·20	1·48	1·81	0·79	1·09	1·51	4·10	3·78
Hopkins River and Mount Emu Creek	1·03	1·48	1·35	0·71	1·35	1·52	3·73	3·71
Mount Elephant and Lake Corangamite	1·22	1·43	1·33	0·84	1·71	1·52	4·26	3·79
Otway Forest	2·00	1·62	2·52	0·99	3·68	2·14	8·20	4·75
Moorabool and Barwon Rivers ...	1·45	1·44	1·26	1·04	3·29	1·67	6·00	4·15
Werribee and Saltwater Rivers ...	1·67	1·48	0·88	1·36	5·94	1·95	8·49	4·79
Yarra River and Dandenong Creek ...	3·08	1·94	1·57	1·28	4·85	2·31	9·50	5·53
Koo-wee-rup Swamp	2·83	1·77	1·63	1·24	5·16	2·15	9·62	5·16
South Gippsland	2·85	2·04	1·91	1·67	5·23	2·32	9·99	6·03
La Trobe and Thomson Rivers ...	3·13	2·15	1·95	1·55	4·35	2·34	9·43	6·04
Macallister and Avon Rivers ...	3·25	2·01	0·61	2·29	4·54	1·65	8·40	5·95
Mitchell River	3·29	2·23	0·91	2·52	7·07	1·95	11·27	6·70
Tambo and Nicholson Rivers ...	2·80	3·05	0·87	1·44	6·14	1·67	9·81	6·16
Snowy River	2·63	3·07	0·77	2·19	5·98	2·50	9·38	7·76
Murray River	1·23	1·37	0·08	1·29	1·42	1·84	2·73	4·50
Mitta Mitta and Kiewa Rivers ...	2·14	1·72	0·24	2·26	2·66	2·17	5·04	6·15
Ovens River	2·45	2·39	0·64	2·01	2·68	2·33	5·77	6·73
Goulburn River	1·38	1·47	0·40	1·06	2·48	1·68	4·26	4·21
Campaspe River	0·97	1·29	0·49	0·91	3·09	1·83	4·55	4·03
Loddon River	0·71	1·11	0·44	0·63	1·77	1·32	2·92	3·06
Avon and Richardson Rivers ...	0·44	0·90	0·25	0·41	1·71	0·95	2·40	2·26
Avoca River	0·46	0·85	0·33	0·28	1·35	1·19	2·14	2·32
Eastern Wimmera	0·34	1·02	0·44	0·32	0·96	0·88	1·74	2·22
Western Wimmera	0·57	1·16	0·59	0·36	1·46	1·20	2·62	2·72
Mallee Country	0·32	0·82	0·12	0·22	0·98	0·88	1·42	1·92
State	1·71	1·64	0·94	1·16	3·15	1·73	5·81	4·53
Weighted averages	1·36	1·48	0·71	0·97	2·59	1·55	4·66	4·00

The distribution of rainfall over the State during the first quarter of the current year, as shown in the above table, may be summarized as follows, viz.:—

Taking first the southern half of the State—

Western Districts. — Rainfall very slightly below average in January and March, and above average in February. Total for first quarter, about the average or slightly above it.

Districts around Port Phillip and Western Port Bays, as far as the Otway Forest on the west and the Koo-wee-rup Swamp on the east.—Rainfall slightly above average in January and February, and more than double the average at most places in March. Total for the first quarter, very considerably above the average generally.

Gippsland and extreme South-east.—Slightly below average in January east of the Mitchell River, and above average elsewhere. Slightly below average in February east of the Latrobe and Thompson Rivers, and above average elsewhere. Excessively above average in March generally. Total for the whole quarter, very considerably above the average everywhere in the south-eastern quarter of the State.

Northern half of the State.—Less than half the average in January over the north-western country from the South Australian boundary to the Campaspe River, and about the average east of the Campaspe basin. Very slightly above the average in February in the Wimmera, but below average elsewhere generally, and excessively dry in the Upper Murray and extreme north-east. In March, slightly below average in Upper Murray districts, but above average everywhere generally. Total for the quarter, very considerably below average in the Murray districts and extreme north-east, below average in the Mallee country and western Wimmera, and approximately near the average elsewhere generally.

Over the State as a whole, rainfall 8 per cent. below average in January, 27 per cent. below average in February, and 67 per cent. above average in March. Total for the first quarter of the year, 16 per cent. above average.

The table for April shows that the amount of rainfall in that month was one of the smallest on record for the whole of the State. At many places in the northern half of Victoria no rain fell during the month of April.

IMPRESSIONS OF VICTORIA FROM AN AGRICULTURAL POINT OF VIEW.

A Paper read at the First Annual Conference of the Victorian Farmers' and Rural Producers' Association, held at Shepparton, 3rd July, 1902.

By S. Williamson Wallace, Director of Agriculture.

Impressions.

I have been asked to give you my impressions of Victoria from an agricultural point of view. This paper will, however, deal more with a few ideas as to how the agriculture of the country may be improved, and if I have formed wrong impressions as to their possible usefulness in Victoria, it must be remembered I have been but a short time in the country.

When a stranger first leaves that marvellous city of Melbourne, and passes into the country, the most striking feature is the millions of dead gum trees, with their bare limbs stretching out in mute witness of their destruction. However necessary this destruction may be, yet to one who has not previously seen it, the idea of waste rises first to the mind.

In March, when as yet no rain had fallen, the dry, barren appearance of the country and the withered grass, made a vivid contrast to the green fields of England. I wondered how animal life could be supported, and if these pastures would ever recover from their apparent barrenness. The country as seen from the railway train, in many districts gives the impression that the homesteads are very far apart, the cultivated area small, and population almost entirely wanting. On closer acquaintance with some localities one's first impressions have to be modified in many respects, but still there is a great contrast raised in the mind of one who has been accustomed to an Egyptian landscape, where the entire surface is covered with crops, the villages more numerous than houses in this country, and farm labourers to be seen working in every field. The day I hope will come when Victoria will present a similar aspect.

Railways.

The splendid system of railway communication in a country settled in little over half a century is worthy of admiration. Whatever criticism there may be as to unprofitable tracks, mistakes as to line of route, and heavy annual deficits, we must remember that if there had not been railways there must have been macadamized trunk roads, with heavy annual expenditure for repairs, and heavy bills to pay for bullock and horse traction, which the country could not have borne,

and consequently must have remained unoccupied and undeveloped. Victoria has done well as a whole in her bold and forward railway policy. Closer settlement, on good land near to railways, more especially in the vicinity of towns, would soon turn the annual deficit to a surplus. It is a mistaken policy to encourage people to cultivate the back blocks while there is good land available, with easy communication, more especially as the price of this land is rising every year and must be handsomely paid for in the long run.

Cattle.

The poor condition of the most of the cattle, more especially of the dairy herds, must be a great source of anxiety to owners. In England, if a farmer had stock in such condition to bring through the winter it would spell ruin, in long bills for feeding stuffs or severe loss in numbers. Conditions are, however, different here, and I must wait to see results. Of this, however, I am certain, that the crossing with every known breed that has ever been imported is a great mistake. In some dairy herds you will see evidence of half-a-dozen different breeds ; cattle quite too mixed to be profitable. I am well aware that first crosses often turn out the heaviest milkers, and make all-round better commercial dairy cattle than any one pure breed, but results can never be satisfactory with careless crossing such as is to be seen in Victoria. I would advise farmers who have these mixed herds, to buy a certain proportion of pure bred cattle of one known good dairy breed suitable to their districts, use a sire of another pure dairy breed, rear the progeny, and continue to use alternately pure sires of the two breeds selected. It will be long before you can establish a good herd by starting with the mixed crosses of the country, however good your pure sires may be.

The Darby Digger.

Better cultivation is undoubtedly one of the means which must be looked to if heavier yields are to be obtained. This naturally comes as the price of land advances. When men farm large areas of cheap land, especially virgin soil, paying crops are obtained by merely stirring the surface of the land, the great ambition of the occupier being to get in a large area with the least possible cost. This system is universal in all new countries, and is well exemplified in Victoria. The time has however come, when farmers on older settlements realize that a system of more thorough and deeper cultivation is essential to the production of paying crops. It is with the object of assisting those who realize this that I will now draw your attention to the advantages of the Darby digger, the most perfect of all steam cultivators, a comparatively new implement which has been perfected only in the last few years, and which I feel certain would play a most important part in tillage operations here. This implement is in the form of a triangular iron frame, and differs from other

cultivators in this; that it is furnished with flanged tines which rotate as the digger is drawn through the ground, the result being that the soil, although stirred to a good depth, is kept practically in the same position, the soil on the top and the subsoil below, so that it is quite possible to go down into the subsoil and stir it without bringing up the clay, which would injure the crop. The plough pan is broken, and air, water, and roots get freely into the subsoil. Rainwater does not stand on the surface or run off the land, but sinks rapidly to the roots of the crop, or to the bottom of the bare fallow or newly-ploughed land, out of reach of rapid evaporation, and is there conserved for the benefit of the next crop.

One cultivation with the digger performs at once all the work of the plough and harrows, and leaves an excellent seed bed ready for the drill. You cannot, of course, operate when land is too wet to plough, but hard land, that the plough cannot touch, can be broken up and pulverized. From the rotative corkscrew action of the digging tools, all weeds are brought to the surface, where they are killed by the sun. The good effect of deep digging lasts for at least four years, so that the cost when spread over that period is not a serious consideration.

The digger can be so adjusted that it will dig at a depth of 2 inches or down to a depth of 10 inches. The cost per acre in England is calculated to be 1s. per inch of depth dug when operating at from 6 to 10 inches. Thus, to dig an acre 6 inches deep would cost 6s. per acre, 10 inches deep 10s. per acre; where firewood is abundant this cost would be reduced. All items are allowed for in this estimate, including up-keep, interest on price, and repayment of capital. The digger can be attached to any type of traction engine, so that the work might be taken up with advantage by those at present engaged in thrashing, baling, and chaffing. I am of opinion that the Darby digger should be given a trial in Victoria.

Model Dairy Farm.

One of the most pressing needs in Victoria is the establishment of a Model Dairy Farm in a central position, to demonstrate practically to all interested, how a dairy farm can be managed on the most approved principles. On such a farm the proper selection of a profitable herd of cows should be paid the utmost attention to, showing how the yield of milk and butter can be increased by a judicious selection and crossing of the best milking strains. Above all other objects this farm should demonstrate how to feed cattle profitably all the year round, by the growth of the most suitable forage crops to supply feed when grass becomes scarce in summer, and by the making of hay and ensilage for winter requirements. The present system of leaving everything to chance in the hope that there will be sufficient dry grass in summer, and abundant autumn rains to provide grass in winter, leads to very serious loss in produce in bad seasons. The advantages of housing in winter is another matter which requires demonstration.

Such a model farm would do little good if not managed on commercial lines, to be convincing you must show a profit. Housing and regular feeding means trouble and expense, which will not be undertaken by farmers unless a profit can be secured. It is difficult to make a Government institution pay, but I am certain such a farm would pay if run on proper lines. I should not of course debit the farm with any part of the time of the experts of the Department, but the salary of the farm manager, labour, rent, and other expenses would be all included when calculating the result.

There ought to be herds of at least two of the best dairy breeds kept on the farm, and the male progeny sold to farmers. In this way a cheap supply of pure sires would be provided. However well the dairy stock was selected, no doubt all the progeny would not be first class, but they would be infinitely better than cross sires, and could be sold at prices within the reach of all breeders.

A dairy factory would be necessary in connexion with the farm, and there it would be possible to give a thorough training in the work and management of the factory to a limited number of assistants who are at present employed in other factories. These men need not remain long at the Government factory, but could return to their former situations, where the practical and scientific training which they had received would at once have an effect on the quality of the butter produced. I say, a limited number of assistants would be employed, in fact, not more than would be required to do the work of the Government factory, as it is impossible to train men without giving them full employment and sufficient pay.

Experimental Farms.

To complete the usefulness of the Chemical Branch, an experimental farm is required; in fact, several are required, but in these times we would be glad to begin with one, in any district where it can be started at the least possible outlay. Others will follow, without doubt.

Now, this is a class of farm that never will pay, you must be prepared to make a loss of a few hundreds a year besides rent, otherwise it would cease to be an experimental farm. On such a farm every experiment should be tried which has a chance of success, and if one-fourth of what is tried is successful, I should consider the farm well worth the expenditure. Failures will save money to the country, if results are properly tabulated and published. This class of work can only be undertaken by Government, for the good of the whole country, or by wealthy individuals who make a hobby of experimental farming. With individuals, results are seldom accurately recorded, and when a manure, a crop, or a grass is seen to be a failure, or a success, the interest in the experiment ends, no accurate weighing takes place, no results are tabulated or records published, so that, as

far as the general public is concerned, there is little benefit derived. With a Government institution, however, it is different, an account must be given of every experiment, and facts must be published, whether they are good or bad, so that all may know how to avoid failures, and give the successful experiments a trial on their own farms. Many experiments, such as rotation of crops, have to be conducted over a series of years to be of any real value, and this continuity can only be secured on a Government farm.

There is, I am afraid, great misunderstanding as to the nature of the plots established by the Department. I have often heard them described as experimental plots, and, no doubt, in Victoria they have been experimental to a very great extent, but their true function ought to be, to demonstrate to the farming community every fact which had been proved on an experimental farm. For example, when it has been found what combination of manures and the quantity per acre to apply to any crop, the fact should at once be demonstrated on plots over all the area where conditions of soil and climate are similar to those of the experimental farm. The same should be done with forage crops, varieties of wheat, grasses, &c. It would be fatal to any officer, and experimental work generally, if every idea had to be worked out at the expense of farmers, and subject to the criticism of every passer by. Every failure would be counted to the discredit of the Department, whereas failures are distinctly useful so long as a certain number of successes are obtained. Progress in experimental work will be slow, and few discoveries of any value will be made, until an experimental farm is established and demonstration plots put to their proper use.

Agricultural Education.

Agricultural colleges, in most parts of the world, have turned out a useful class of men well qualified to become excellent professors and teachers of agriculture, intelligent pressmen, and good civil servants, or, in fact, have enabled the farmer's son to improve his position, and enter other walks of life allied to agriculture, to which he could not have attained had he not received the scientific training given at an agricultural college. I have known many of those men, and although some are well contented with their change of profession, the majority regret that they ever left the land, assuring me that with the knowledge they acquired they could have made more money at farming and known less of the troubles and disappointments of life. It is, in my opinion, the duty of the State to give only that amount of scientific instruction in its agricultural colleges which will enable the farmers' sons to profitably carry on their business, otherwise the best and smartest men will be lost to the farming community.

Another vexed question in connexion with agricultural colleges, which has always been hotly discussed, is whether practical work is a necessary part of the college training for a farmer's son? For those who know nothing of farming, no doubt it is an advantage, but for a

farmer's son to leave his home to perform the work of a labourer, a ploughman, or a dairyman is at least a course of questionable value. If he were being taught the direction of labour, the management of stock and other branches of farming industry, no doubt it would be profitable to him, but to perform much of the manual labour as it is done on a college farm is to a practical man a waste of valuable time. No farm work is done by students, nor will ever be done by them, in the thorough manner in which the same operations are performed where family labour is employed on a commercial farm. A farmer's son should learn practical work at home, under the guidance of his father, where he knows that energetic labour is for the benefit of himself and his parents.

The true function of an agricultural college is to teach the principles which underlie good agricultural practice, and the allied sciences which enable a farmer to have a proper understanding of these principles. No man can read with proper interest and profit the agricultural text-books of the day, or understand the true bearing of lectures on any branch of agriculture treated from a scientific point of view, without some knowledge of chemistry and botany. Now, do the farmers' sons of this State, or of any other country, attend colleges for the purpose of gaining scientific knowledge? Some do, but not in sufficient numbers to greatly benefit the agriculture of the State. I am sure it is not from any opposition to science on the farmers' part, or the want of an appreciation of the fact that a better knowledge of chemistry would aid him in judging what manures were required for his crops, and enable him to form a better estimate of the relative values of the different manures in the market.

The difficulties in the way of the farmer's son obtaining scientific teaching are practical difficulties; the college course takes him away from the farm immediately after he leaves school, just at the time when he should be getting a thorough training in all farm work under the guidance of his father. If he does not get this training as a boy, he will never take kindly to it later; there would be the utmost difficulty in forcing a young man who had spent all his boyhood at school and college to take to the hard work and long hours that are necessary to earn a living on the land. There is also the serious matter of employing some one else at high wages to do the work which a son ought to do as soon as he leaves school. The difficulties in the way of farmers sending their sons to college are great and real, and, if they are to get scientific training sufficient for their business, other means must be found of supplying it.

In Victoria you have adopted the method of teaching by travelling instructors. We have experts from the Department of Agriculture travelling through the State delivering lectures in various centres on agriculture, dairying, viticulture, horticulture, and other subjects, which arouse considerable interest and inquiry, and undoubtedly do a great amount of good. This system I should like to see further

extended, as it brings help and knowledge to those who are most anxious to obtain it, and who can at once turn what information they acquire to practical use; and, moreover, this is the only instruction we can hope to give to those who have come to the prime of life and have farms to attend to and families to provide for.

There is, however, the young farmer who has worked steadily on his father's farm for several years after leaving school, who is well up in practical work, but feels that he would like to know something more of the principles which underlie his practice. He feels when he tries to read scientific books, however simple, that his lack of a knowledge of chemistry and botany prevents him from understanding the full meaning of the text, consequently he loses interest, and lays his books aside. This is the class of man who ought to have instruction provided for him; and I would propose to do so by establishing a short winter course of instruction in chemistry, botany, and agriculture. Agriculture would be taken in its widest sense, including lectures on dairying, viticulture, and horticulture.

To secure a large attendance it would be necessary that the length of the course should not exceed two to three months, and be held immediately after ploughing and sowing is completed in the autumn, and end before spring work begins.

Every family could spare one son during this season, with the assurance that he would be gaining useful knowledge, and would not be the least impaired for hard work on his return to the farm. No practical work would be attempted, the lectures would be three per day, and the rest of the time occupied in study, mainly in getting up the subjects of the lectures and reading text-books recommended by the teacher, which would enable the student to better understand the instructions given. Two examinations would be held each session in each subject, and class certificates would be given to those who obtained a certain percentage of marks. For all youths under 21 these examinations would be compulsory; for men over that age, examinations ought to be optional. No entrance examination would be held, the only qualification being that the student should be a farmer, the son of a farmer, or have worked at least two years on a farm. It is of little use men attending such classes who have not previously gained practical experience; besides, it will be better for all concerned if the men belong to the agricultural community only. We do not wish to create a class of theoretical farmers. As such courses have been attended in other countries by men of all ages, every appearance of school discipline should be avoided; orderly conduct in the class-room is all that should be insisted upon. When men have left school for some considerable time, they feel diffident about examinations, consequently these should be optional, so that no one may be deterred from attending and gaining what knowledge he can.

The place of meeting should be in some country town provided with a hall or class-room. Personally, I think it should not be in

Melbourne, nor should it be in any large provincial town. The smaller the town the better, provided the place is big enough to provide lodgings at a cheap rate for the students, who, of course, would pay for their own maintenance. Such classes held annually would, in my opinion, supply a great want.

Let me repeat that it would enable every man, who attended for even a single session, to read intelligently the current agricultural literature of the day, and thus keep himself in touch with the results of scientific research. He would derive greater benefit from the lectures given by the experts of the Agricultural Department, and would join in the discussions which follow with benefit to himself and others. Finally, his knowledge would greatly aid him in farming, especially in dealing with the question of manures, which must figure much more largely in Victorian farming than it has done in the past.

However good any scheme may be, nothing can be done without your co-operation. We cannot start colleges, schools, or classes without students, and it is for you to provide them. There is plenty of time for organization, as the classes could not be held before next winter, and in the meantime I hope to hear that students will be forthcoming.

Dookie Agricultural College.

I trust that no one will infer that I do not appreciate the good work which is being done at Dookie Agricultural College. In this new country such an institution is an essential part of any well-conceived system of agricultural education.

It is essential for the good of the community that as many people as possible, of all classes, should be induced to settle on the land, and, when men have not been brought up upon the land, there could be no better training than two years work at Dookie College. Too many people attempt farming with no practical training whatever, and consequently with disastrous results to themselves and loss to the community. How many of those who have adopted farming as a profession would have saved their capital had they had the training which is given at this institution.

There is also in the country a very large class of farmers who have very little knowledge of the best farming practices, and who are not in a position to give their sons a sound practical training. After a course at the Agricultural College their sons would return home well qualified to improve the methods adopted on many farms.

There is besides a class of wealthy farmers who do not insist upon their sons doing practical work to train them for their business, a course at the college would be most beneficial in these cases.

There is positively no clashing of interests between the "short course" I propose and the present institution. The short course of scientific instruction is intended for those who have not the time to go to college, and who feel a want of scientific knowledge which

at present they cannot obtain anywhere except at a sacrifice of time which they are unable to make. These are men who are thoroughly acquainted with all farm operations, and whose time would be wasted in ploughing and sowing any land but their own.

At Dookie the disadvantages which attend the course at most agricultural colleges are very wisely provided against. Students devote one whole day to practical work and one to study, so that the bodily toil does not interfere with their capacity for book-learning. With a good night's rest they are neither tired nor sleepy in the class-room, and the toil of farm labour, which is hard to those unaccustomed to it, is greatly mitigated by the intervening day of study. The scientific instruction given is sufficient to qualify a man to become a good and intelligent farmer, but does not qualify for professors, teachers, or chemists, except in cases where students supplement their learning by private study and have a special fondness for the work. For such men as these there ought to be a higher course of instruction fitted to develop their talents, so that they might ultimately supply the country with a much-felt want, namely, scientific instructors. The University is clearly the place for such higher teaching. There should be a chair of agriculture, and a course of lectures arranged on allied sciences. Victoria alone could not supply the numbers necessary for such a University course, nor would the State require the services of any large number of men having a degree in agriculture. One class in one University would be sufficient for all Australia, and until this is arranged Australia will still have to seek assistance from abroad, which is expensive, and obviously unfair to those born in the country.

Irrigation.

In Egypt there are two distinct systems of irrigation, one the "perennial" or canal system, and the other the "basin" system. The perennial system is in operation in the northern part of the country or Delta, and is of comparatively recent origin, being introduced in 1820 by Mohammed Ali, the great-grandfather of the present Khedive. The "basin" system is applied to 1,700,000 acres, extending for over 400 miles to the south of Cairo, along the banks of the Nile, and has been in use from the time of the Pharaohs.

Canal Irrigation.

The system of canal irrigation may be shortly and roughly described as follows:—Immediately to the north of Cairo, a barrage or weir is built across the Nile where the Nile divides into two branches. This open dam consists of solid masonry, is 1,000 metres (3,280 feet) in length, and has 132 openings, each 5 metres (about 16 feet) wide, which gives a waterway of over 700 yards, through which the flood waters of the Nile pass. When the river falls, gates are lowered into the openings until they are closed,

and, practically, every drop of water in the river is held up by the structure. The barrage was begun by Mohammed Ali in 1842, and completed in 1865, thus taking 23 years to construct, at a cost of between £3,000,000 and £4,000,000. This expensive work was then found to be deficient in its foundations, and was never closed along its full length until 1884, nineteen years after construction. During all this period the country derived very little benefit, and it was contemplated to abandon the system of irrigation by gravitation, and to saddle Egypt with the enormous cost of lifting water by steam power—a burden which even that fertile country could not have borne. Fortunately, the English occupation came in 1882, and saved the situation. The first extensive repairs were completed by English engineers from India in 1891, and the last works designed to strengthen the structure were finished in 1901. Two generations passed before the full benefits of the undertaking were secured, and much disappointment and suffering has been the lot of the agricultural community. The vacillation of the Government and want of money were the main causes of delay. *This sad story has its moral, and is well worth close study by any* other country contemplating heavy expenditure on irrigation works.

The purpose for which the barrage was erected was not to store water against times of scarcity, but to raise the water from a lower level to a higher, to enable it to be delivered by gravitation on to the cultivated land. The head of water held up is 4 metres (13 feet) above the level of the river-bed. Three main canals receive the available supply of 430 cubic metres (16,000 cubic feet) per second. This is distributed by branch canals over 3½ million acres, half of which is under summer crops. One cubic foot per second will irrigate 115 acres of summer crops.

The construction of these canals cost 6½ million pounds, add to this 3½ million pounds for the approximate cost of the barrage, and you have a capital cost of £10,000,000 for the irrigation of 3½ million acres, besides the cost of subsequent expenditure on the works, Nile banks, and annual up-keep. Canal irrigation, then, is an expensive undertaking, even in an old country with hereditary practical experience and abundance of cheap labour to take full advantage of the water when it is provided. Considering, then, the cost of this system, I should like to turn your attention to an entirely different system for utilizing flood waters, which requires no canals, weirs, or storage basins.

The Goulburn in Flood.

During a series of ten years I find that in nine years out of ten the maximum flood of the Goulburn River exceeded half-a-million cubic feet per minute, and in four years it exceeded 1,000,000. Now, when the western channel is completed to the Waranga basin, this channel will still be the only means available to reduce the winter and spring ...ds. The capacity of this canal is a little over 100,000 cubic feet per course ..., so that its carrying power, as a rule, will only equal one-fifth scientific ...hest flood waters of the Goulburn, and four years out of ten to go to co...

it will carry less than one-tenth. The Goulburn will consequently be in flood every year, and so will the Murray and its tributaries for many generations to come; in fact, until money has been found to store the vast supplies of flood water that are available. I say it will be generations, because if money were *now* available, to at once complete the works, there would still be the unsurmountable difficulty of the want of population. To pay interest on capital expended, the country must be under an intensive system of cultivation, requiring much labour, heavy manuring, good cultivation, and a succession of crops. This must, then, be a gradual process, and the question arises—"Could we not do something in the meantime with the flood waters of the Murray which must at present run to waste?" The flood waters of the Nile are made something of in Egypt; so I think it would not be out of place for me to give here a short sketch of the methods which are there adopted.

Basin Irrigation in Egypt.

The portion of the country under basin irrigation lies to the south of Cairo, 400 miles towards the Soudan, along the banks of the Nile, and has an area of over 1½ million acres. The natural slope of the country not only follows the flow of the river, but slopes back from its banks on either side until it meets the mountains, which shut in the whole length of the valley. The highest land is consequently on the river banks, and the lowest on the edge of the desert. It will be seen, then, that by cutting through the high land, or natural banks of the Nile, the whole valley can be put under water. This is what is done, but under a thorough system of control. Short canals are cut through the banks at frequent intervals, the levels of the beds of the canals being midway between the level of low and high Nile, so that as soon as the floods have risen to half their height the canals could take water. As a matter of fact, for various substantial reasons, water is not allowed to flow before the floods have reached a much higher level. To regulate the water when once admitted to the country, there exist a great number of transverse dykes, or earthen banks, running between the river and the mountains; the portion so enclosed is called a "basin," two sides being formed by earthen banks, the third by the river bank, and the fourth by the mountains.

There are 212 basins in Upper Egypt, with a mean area of nearly 7,000 acres, covering a country of 1½ million acres in extent. The two largest basins are 50,000 and 75,000 acres respectively. The basin banks have an average top width of 6 metres (19½ feet), a height of 3½ metres (11½ feet), and a slope of 1 in 1. The average depth of water held is 1½ metres (5 feet). Each basin is not provided with an opening to the Nile, but to arrange for regular filling the basins are in chains, with feeder canals passing the transverse banks, so that the water can be fed from one basin to another throughout the whole length of the chain. The lowest basin in the chain is provided with an escape to the Nile, so that when all are filled, and the river has fallen sufficiently, the whole of these basins can be emptied and dried for cultivation. The

process of filling the most southern chain of basins begins generally on 12th August and is completed on or about the 1st of October, the escape to the Nile is then opened, and the lowest basin is dry by the 15th October, the whole operation extending over 64 days.

As the water recedes in the basins the seed is sown broadcast upon the wet soft mud, even before the last water has disappeared from the surface. To this seed no covering whatever is given, it germinates in the moisture and soon throws roots down into the soil. Another method is to postpone sowing until the land is just dry enough to plough, seed is then sown broadcast and ploughed in. The crops are principally wheat, barley, beans, and clover. These crops receive no further watering whatever, and, as the surface dries, the roots follow the moisture deep down into the subsoil. The cereal crops grow a fair bulk of straw, come to maturity, and yield grain of good quality. The clover crop gives two cuttings, one full cutting followed by a lighter cutting, which is often eaten off or left for seed.

Basin Irrigation for the Mallee.

When I was appointed to my present position my first thoughts were—"Would it be possible to apply this cheap system of irrigation to any part of Victoria?" It was therefore, with great interest I read the information given by Mr. Catani, regarding the levels in the Mallee, and the possibility of cutting the banks of the Murray to allow of water passing along old river courses, to supply drinking water for stock, and ultimately find an outlet to the Murray further down-stream. There seems every reason to believe that the basin irrigation system of Egypt, which has stood the test of 5,000 years, can be applied to the unoccupied portion of the Mallee. The system would be the same in principle, although modified in many of its details. I would, if possible, cut the banks of the Murray not at one place only, but at several, so that as much of the top flood would be got as possible. As in Egypt, these cuttings would have a level between low water and high flood, which would not interfere with navigation, and would relieve to some extent the districts which at present suffer from flood. When this was done, all that would be necessary would be to select places where earthern banks could be easily and cheaply erected, and where the land behind the bank was flat enough to secure a considerable area of flooded country. Such places would be found where the old river bed passes through between rising ground on either side, thus necessitating a short and low bank. Each bank would be provided with a regulator, so that by shutting the regulator a few thousand acres would be flooded, and when opened the basin would empty, and the land be left to dry. The land would soon be ready for the plough and seed, and would require no further attention until the crops had grown. The water thus released from the first basin would pass on to fill the next, and so on, until the outlet to the Murray was reached. The loss from soakage into the dry soil, and from evaporation, would be very considerable, but would be replaced by the flood water entering

from the Murray down the water-course and through the basins that had been already dried, until it reached the basin that was being filled at the time. From the rolling nature of the mallee country I am well aware that not nearly all the land could be cheaply flooded in this way, much of it would stand above the height of the banks sufficient to cause the lower area to be flooded, but in this there would be several advantages, the higher ridges would form two sides of the basins, the bank to be thrown up across the water-course the third, and the fourth would not be required, as the water up-stream would tail out to nothing. The high land could be sown with wheat as it is at present, on it the homesteads would be erected, and the stock would be kept while the basins were full or the crops growing.

If this system is adopted the country would have to be again surveyed, and farms mapped out with portions of high land and portions of basin land in each holding. Each part which seemed likely to be a profitable basin would have to be considered on its merits, the length and height and expense of the bank required would have to be estimated, the area that would be irrigated ascertained, and a calculation made as to whether it would pay to form a basin in that particular spot or not. There need be no risk and no unprofitable outlay. When a basin is once filled the water must stand a sufficient time to soak through the soil and saturate the subsoil to its fullest extent, so that there would be moisture left in the subsoil for the crops to draw upon when the surface became dry. As the land irrigated would be very slightly above the level of the new river flowing through the basins, the drainage from the subsoil would be slow, and loss of moisture would be principally from evaporation.

Basin irrigation always enriches and sweetens the land. Fine silt and clay settle from the flood waters, and greatly improve the mechanical condition of light soils, besides adding a considerable amount of fertilizing matter. The question of shifting sand would be at an end wherever the water reached. When water is held up over the land, the salts on the surface melt and are carried away in solution, thus one of the greatest difficulties in connexion with irrigation is avoided.

The next question of practical importance is, when, and for how many days, would water be available? I am told that when the flood rises 3 feet above summer level, there is sufficient water in the Murray for navigation. The sill of the intake canal could therefore be cut to this depth. I have taken 1884 as a dry year, and find, from the levels at Swan Hill, that water will flow in a canal of this depth for 276 days in the year, and if you take a wet year, namely, 1889, water will flow for 323 days. I have, however, based my calculations on a flood of at least 4 feet above summer level, so that we would have at least a flow of a foot deep into the canal, which would be an appreciable amount. I find that in a dry year we would have water flowing into the Mallee at varied depths from 1 foot to 6ft. 8in. for 250 days in the year, and in a wet year for 314 days at varied depths of from 1 foot to 10ft. 7in. You will see that this is a very considerable depth of water and capable of great possibilities. In 1884 the level of 4 feet

was reached on 30th May, and continued, above this, with the exception of five days in June, until after the end of the year. In 1889 I find that the flood rose on 25th April to over 4 feet, and continued above this level until the end of the year, with the exception of six days in May. If we consider 60 days to be sufficient to pass drinking water along the course of the new river as well as to fill the first basins, you would have the land in the basins nearest to the Murray ready to sow in the beginning of July in a wet year, and in the beginning of August in a dry year. In 1884 there was water enough for irrigation until 21st February and in 1889, until the 12th March. In ten years, from 1890 to 1899, the river rose 4 feet and over above summer level for an average of 253 days in the year. In two years only was the number of days less than 200. It will be seen from these figures that there is plenty of water, and for a sufficient length of time without storage or any elaborate system of canals.

The next consideration is, what will be the crops cultivated? Land would be available in spring, in July or August, in the basins near to the Murray, and at a later period in basins further away. Experiments would have to be conducted before any complete list of crops, certain to succeed, could be made, but with abundant sunshine, a moist seed-bed, and a saturated subsoil, a successful selection of crops could be grown.

Combination of Basin and Canal Irrigation.

So far we have been speaking of applying the basin system pure and simple, as practised in Egypt, where the crops are grown after the land has been saturated, without further irrigation. However, the Mallee would not require to rely upon this alone. We have seen that *the low land adjoining the new river can be flooded, saturated, dried,* and sown with crops. This land would be little above the level of the water-course, consequently it would be easy to irrigate in summer by small irrigation canals taken off up-stream of the basin at a sufficient height, and constructed round the skirt of the basin just above the water line. As these canals would carry water above the level of the growing crop, these crops could be irrigated from them several times during the season. It may be argued that there would not be enough water for basin irrigation and canal irrigation at the same time; there is, however, plenty of high-flood water in the Murray which is useful to nobody, hurtful to many, and available for generations; so that the only question to consider is the number and size of the openings to be made in the river banks. Besides, the water in the higher basins is available to assist the filling of the lower basins in the chain, so that irrigation could be proceeded with as soon as the first-sown crops require it.

What a transformation there would be in the Mallee if we had water running in all the old river beds for even 200 days in the year, and a strip of green country, in places miles wide, giving food and water to stock for many months. The country would be habitable and profitable, and until this is done it will be impossible to go further with settlement.

I am certain that a very small percentage of the present settlers had the least idea of the trials they have had to face, or they would never have invested their all in the mallee country.

This scheme only provides for the country which is not yet settled, where there are no vested interests to be considered, as the land reverts to the Crown in 1903. This is not an alternative water scheme in competition with any other. Mr. Catani's idea of cutting the Murray banks is an essential part of it, and I know of no other scheme which provides for this district. I see no good reason why the flood waters of the Murray should not be utilized in this way, provided always that the right to do so is secured for Victoria. I have no right to discuss other schemes of irrigation at present before the public, but may wish them every success, as water and water alone will make the northern area of Victoria prosperous.

NOTE.—I am indebted for a number of figures to "Egyptian Irrigation," by W. Willcocks, C.M.G., late Director-General of Reservoirs in Egypt.

CHEMISTRY.

RESULTS OF MANURE EXPERIMENTS, 1901-2.

(*Continued from page 560.*)

By F. J. Howell, Ph.D.

A Criticism of the Results of the Experiments.

BENDIGO GROUP.—(For results see Tables.)

A cursory examination of the general average of this group indicates clearly that manures have acted well; the average of all the unmanured plots working out at 10·48 bushels only, that of the manured giving 14·87. But a closer examination of the results of each field in detail will disclose irregularities which must prevent one from attaching too great an importance to the figures of the general average. In the returns, for instance, of Mr. Long, of Axe Creek, the yield on the unmanured plot 2 is seen to be only little more than half of what each of the other three unmanured plots gives. This low comparative yield on the first unmanured plot causes an apparent increase on plots 1 and 3, out of all proportion to the quantity of manures given. These returns, then, cannot be accepted as of any great value. From plot 5 to 12, however, there appears in this field a recovery in uniformity. The returns from Mr. Curnow, Mr. Carter, and Mr. Stewart, are very regular, and give evidences of careful working. The increased yields in the first two cases are marked, and bring out the highly profitable nature of manuring. The superphosphate in the three fields, as over the greater part of the State, has proved the most effective and profitable of the phosphatic manures, Thomas Phosphate showing to less advantage. In the first and last field, however, there is an apparent difference in favour of Thomas Phosphate. The want of regularity generally in these two fields renders it, however, advisable not to attach too great an importance to the returns. It seems evident that nitrogen in the shape of dried blood has shown a more marked effect on these soils than is usual in the northern areas. This is notably so in the case of Mr. Curnow. The explanation, perhaps, lies in his case in the presence of the sandy ridge running through the field. It is precisely on soil of such a nature that the manure in question might be supposed to show results. There seems, also, to have been an appreciable increase due to the blood on plot 12 of Mr. Leathlean's field; but the low yield of the adjoining unmanured plot, compared with the others, and the irregularity of the field generally, inclines one to the opinion that the large increase might be more apparent than real. An interesting fact, disclosed in the results of Mr. Carter, is the much larger increase where the sulphate of ammonia has been given as a top dressing (plot 18) six weeks after the crop came up, than where it was applied with

the crop; although, even here, it has apparently done no good to the crop, the increased yield not being quite as large as where the superphosphate alone (plot 6) was applied. On plot 13 of Mr. Leathlean, it appears that the addition of lime to the superphosphate has resulted in a much larger increase, as is evident in comparing the increased yield on this plot with plot 3. Other facts in the field seem to point to the accuracy of these figures and indicate that some slight benefit might follow the application of a lime manure to this soil. The facts referred to are the larger increase produced by Thomas Phosphate than the ordinary superphosphate, and the greater apparent effectiveness of the ordinary than an equivalent quantity of the concentrated form, as shown on plots 6 and 3. It will be known that Thomas Phosphate contains a good deal of free lime, and that the ordinary superphosphate carries a quantity of sulphate of lime (gypsum), which is not the case with the concentrated form. It would, however, be unwise to draw conclusion from the returns of a single field, showing the irregularities that are present in the case in question.

The Maryborough Group.

The increases due to manures in the two fields of this group are more marked than in the fields just dealt with, but the irregularity in Mr. Wilson's returns destroys a good deal of the information that might have been obtainable otherwise. It is quite unusual that unmanured plots should show differences in yield amounting to nearly eight bushels, as is the case in the returns of plots 2 and 8. The results, however, from plots 4 to 12 appear reliable. It is quite evident that the two soils of the district have responded well to the action of the phosphatic manures, and there seems every reason to believe that the application of these only will meet, for some time to come at any rate, all requirements for the profitable growth of cereals. There were returns obtained from four fields in this district last year, and the results obtained in the experiments under review are, as a comparison will show, confirmatory in the main essentials with those of the preceding year.

THE PROFITS OF MANURING.

Taking the general average of the two groups it will be seen that the use of, comparatively speaking, very small quantities of manures might result in high profits to the farmer. This is evident in the following tables :—

——	Plot 1.	Plot 3.	Plot 4.	Plot 6.	Plot 7.
	s. d.	s. d.	s. d.	s. d.	s. d.
Value of increased yield due to manures, at 3s. 3d. per bushel	11 4¾	16 9¾	21 9	15 3	15 1½
Cost of manure per acre	1 4	2 8	4 0	2 2	2 2
Profit due to manuring	10 0¾	14 1¾	17 9	13 3	12 11½

The Yarrawonga Group.

As in other parts of the State, the soils of this district have responded well to the phosphatic manures. A noteworthy feature, however, is the apparent greater effectiveness of Thomas Phosphate compared with the superphosphates than is the case in most other districts of the State. This is possibly due to the additional action of the free-lime contained in Thomas Phosphate—an assumption that will find justification in a further examination of the returns. A feature, also, that might strike one on looking at the general average is the appreciable increase following on the addition of nitrogen to the superphosphate, as evident in plots 10 and 12 compared with plot 6. This, however, is probably more apparent than real. Before attaching too much weight to opinions that might appear deducible from an examination of the general average for the district, attention must be called to certain irregularities in the individual returns, which have naturally influenced the general results. An examination of the four unmanured plots of Mr. J. Willis, of Lake Rowan, will reveal very great differences in yield. Such differences indicate either an unusual want of uniformity in the ground, or are due to causes of various kinds quite independent of natural variations, such as error, injury to crop, &c., &c. On plot 11, unmanured, it will be seen that the yield has only reached 6·33 bushels, compared with 13·16 bushels on plot 5, also unmanured. Such differences due to natural variations in soil in such a small area as our experimental fields are quite unusual. Such a small yield on plot 11 makes the increased yield on the adjoining plot 12 appear exceptionally high, and, compared with plot 6, it seems that the addition of the nitrogenous manure, dried blood, has resulted in an increased yield over that produced by the superphosphates alone of 5·66 bushels. The unmanured plots on the farms of Mr. Carlisle, George Holmes, and Gilbert Holmes are fairly regular, and give evidence of both average uniformity of soil and careful working. An exception might be made on plot 11 of Mr. Gilbert Holmes. An examination of Mr. Carlisle's returns indicate that the soil of this farm naturally must be one of high productivity, evident in the large yields without manure, but that the phosphatic manures, in the shape of superphosphate and Thomas Phosphate, have resulted in an increased yield of 3½ and 3 bushels respectively. The nitrogenous manures, as is evident in plots 10 and 12, have resulted in no appreciable increase over the phosphatic manures alone. Comparing plot 13 with plot 6, the interesting fact seems to be revealed that the addition of gypsum (sulphate of lime) to the superphosphate has produced a marked effect, resulting in an increased yield of 5·17 bushels, compared with 3·50. These figures, indicating a deficiency of lime in the soil, seem to find confirmation in plot 19, where an addition of lime only has resulted in an increased yield of one bushel. The returns of Messrs. George and Gilbert Holmes are largely confirmatory of those of the field just dealt with. The action of the phosphatic manures on both these soils have been even more pronounced than in the first case, while the addition of nitrogen in plots 10 and 12 has most probably produced no very

appreciable increase, although the irregular yield on the unmanured plot 11 of Mr. Gilbert Holmes might on first inspection appear to give evidence to the contrary. It is quite possible that both these soils, as perhaps the soils of the district, may be further benefited by the addition of lime to the superphosphate in the shape of gypsum (not slaked lime). I should hesitate to speak too definitely on that point until further experiments in that direction had been carried out, but the returns before me all seem to indicate a deficiency of this ingredient in the soils experimented on. The benefit that might follow an addition of lime seems clearly brought out in plot 19 on the farms of Messrs. Carlisle, Willis, and Grogan. It the case of the first and last there has been an increase of one bushel, while with Mr. Willis the increase has exceeded two bushels. Farmers will of course understand that they must not mix burnt lime (slaked lime) with a superphosphate, but must give lime, if they desire to mix with a superphosphate, in the form of gypsum. To sum up, the farmers of this district may be advised in full confidence to apply from 50 to 75 lbs. of an ordinary superphosphate per acre, and there is every probability that 56 lbs. of gypsum added to this will result in still better yields.

The Rutherglen Field.

The returns from the field of Mr. McKnight are of a most satisfactory nature. The increases due to the various manures show great regularity, and are similar in most respects to the returns from the greater part of the State. There is a gradual increased yield corresponding to the larger quantities of manure used from plot 1 to 4. The returns from the ordinary superphosphate on plot 6 exceed those from the equivalent quantity of Thomas Phosphate on plot 7, but not to the same extent as in many other parts of the State, a fact leading one to suppose that the free lime in Thomas Phosphate may have also slightly acted in this case as perhaps in the Yarrawonga District. The better returns also on plot 6 than on plot 3, where an equivalent quantity of phosphoric acid had been used, only in a more concentrated form, inclines to the same opinion; for the ordinary superphosphate contains a quantity of lime, as gypsum, not present in the concentrated form. The very slight increases on plots 10 and 12, where besides phosphoric acid nitrogen has been applied in the form of sulphate of ammonia and dried blood, over plot 6, where phosphoric acid only, in the shape of a superphosphate, has been given, is a strong indication that these soils are at present so well provided with nitrogen for cereal growing as to offer little inducement to the farmer through the small gain that might follow to apply this costly ingredient to his soil. The fact stands out very clearly in the returns of this field that the application in comparatively small quantities of a superphosphate will pay handsomely, and the test is well worth the trouble of making on a small scale at first, whether an addition of half a cwt., or even less, of gypsum to the superphosphate might not result in a further profitable increase.

THE PROFITS OF MANURING.

It will be of interest to the farmers in the district to examine the very substantial profits which might be supposed to follow the use of phosphatic manures on their soils. Taking first the average increase of the five Yarrawonga fields, we find the profits as follows :—

——	Plot 1.	Plct 3.	Plot 4.	Plot 6	Plot. 7.
Value of increased yield due to manures at 3s. 3d. per bushel	9s. 2d.	15s. 0½d.	15s. 7d.	13s. 2½d.	14s. 2d.
Cost of manure	1s. 4d.	2s. 8d.	4s. 0d.	2s. 2d.	2s. 2d.
Profit due to manuring ...	7s. 10d.	12s. 4½d.	11s. 7d.	11s. 0½d.	12s. 0d.

In the case of the Rutherglen field the profits are very much larger. As the returns in this case are very regular, greater reliance might, I think, be placed upon the varying results from the different plots of this field than the general average of the Yarrawonga group, which, as before stated, has been somewhat influenced by the irregularities of some of the individual plots :—

——	Plot 1.	Plot 3.	Plot 4.	Plot 6	Plot 7.
Value of increased yield due to manure, at 3s. 3d. per bushel	10s. 0d.	17s. 6¾d.	17s. 8d.	14s. 11½d.	14s. 11½d.
Cost of manure	1s. 4d.	2s. 8d.	4s. 0d.	2s. 2d.	2s. 2d.
Profit due to manuring ...	8s. 8d.	14s. 10¾d.	13s. 8d.	12s. 9½d.	12s. 9½d.

Boort—Wycheproof Group.

An examination of the three groups indicates that the extremely unfavourable season of last year was particularly felt in this portion of our State. The yields right through are low, and the operative effects of manures, although strongly evident, by no means so pronounced as they would be under more favourable conditions. That the season was an exceptionally trying one appears from the extracts selected from correspondence received at this office. Mr. Tunstall, of Mysia, writes—"As I told you on the occasion of your visit, that, in common with the crops generally in the district, the plots could only be regarded as failures, owing to bad autumn and unreliable winter rains." Mr. F. G. Smith, of Barrapoort, says—"This is one of the driest years I have seen here." Mr. G. Jones, of Wycheproof, gives the information—"The result is poor, but the season has been so dry that nothing else could be expected"; and Mr. Cossan, of Yeungroon, writes to the same effect. All these letters give undeniable evidence of the severity of the season, and there seems everywhere the suggestion that the experiments have been so influenced by the season, as to have ended practically in failure; but an examination of both the general average of

the three groups, as well as that of each group in detail, will reveal the fact that the use of suitable manures has, even under the most unsuitable conditions, produced very appreciable increases, increases which, over large areas, would still deserve the consideration of our northern farmers. Taking the ordinary superphosphate on plot 6, as the only manure required by the soils of the three districts—we find that 51 lbs., costing 2s. 2d. per acre, has, in the general average of the eleven fields, produced an increase of 3·07 bushels. This, at 3s. 3d. per bushel, gives a profit of 7s. 10d. per acre, an amount which, with the low general yields, might mean much to the farmer.

The Boort Group.

With the exception of the results obtained by Mr. Slatter, the yields of this district are low, but the increases due to manures as appearing in the average for the district are satisfactory. It appears evident from the returns of this group that an addition of nitrogen to the soils of the district has not produced a very appreciable effect. On plot 10 there has been no additional increase, while on plot 12 the nitrogen of the dried blood, although apparently producing a certain effect, has not done so to an extent justifying its application. From the facts on hand, one feels justified in thinking that the only deficiency of the soils deserving present consideration is phosphoric acid, and from the figures of the tabulated return, it is clear that the ordinary superphosphate has shown itself the most effective of the phosphatic manures. From the returns on plots 13 and 19, it would appear that the soils might be benefited slightly by the addition of lime. The large deposits of gypsum in the neighbourhood of Boort, and the low price at which this can be obtained, would suggest gypsum as the best and cheapest form in which to give lime, and a few tests might be carried out by this Department in this direction if requested. Until such experiments have been carried out, I should hesitate, on the returns of two fields only, to recommend the use of gypsum generally with superphosphate. From the facts before me, I can confidently recommend the farmers of this district to use superphosphate with every crop they put in, and there is the possibility that better results might be obtained by mixing this with 56 lb. of gypsum per acre. The profitable nature of phosphatic manuring, even under unfavourable conditions, will appear in the value of some of the increased yields in the average of the district:—

——	Plot 1.	Plot 3.	Plot 4.	Plot 6.	Plot 7.
	s. d.	s. d.	s. d.	s. d.	s. d.
Value of increased yield due to manures, at 3s. 3d. per bushel	6 7	8 10	13 9	12 10	7 2
Cost of manure	1 4	2 8	4 0	2 2	2 2
Profit due to manuring ...	5 3	6 2	9 9	10 8	5 0

The Wycheproof Group.

A comparison of last year's returns with those of the preceding year will disclose how seriously the unfavourable season in the first case has affected the yields. In the first year's experiments, we obtained as an average of the six plots, fertilized with phosphatic manures, the splendid figure of 22·26 bushels. The average of the corresponding plots of last year barely reached 6 bushels. The effect of unfavourable climatic conditions is even more strikingly brought out by a comparison of the unmanured plots for the two years. In the first case the average of the four unmanured plots figured out at 19·09 bushels. Last year the average of the same plots only reached 4·59 bushels. The increases due to manures were last year only half of what they were in the preceding year, but, even at the reduced figures, showed an appreciable profit, as is evident in the following tables :—

—	Plot 1.	Plot 3.	Plot 4.	Plot 6.	Plot 7.
	s. d.	s. d.	s. d.	s. d.	s. d.
Value of increased yield due to manures, at 3s. 3d. per bushel	5 0¾	4 6¾	7 3½	6 11	3 8¾
Cost of manure per acre ...	1 4	2 8	4 0	2 2	2 2
Profit due to manuring ...	3 8¾	1 10¾	3 3½	4 9	1 6¾

The results of the experiments of last year are largely confirmatory of those of the preceding. The pronounced soil deficiency is clearly phosphoric acid, and the superphosphate has shown a marked superiority over the other phosphatic manures as a means for supplying this. The returns on plots 19 and 21 of Mr. Peter's farm seem to point to the fact that further tests might result in interesting facts.

The Charlton Group.

The average of the returns of the Charlton Group has been somewhat interfered with by the erratic results of Mr. Cossan, and attention might preferably be confined to the fields of Mr. Kendall and Patterson. These show a sufficient regularity to make them of value. These is no doubt of phosphatic manures having proved effective on these soils,—the superphosphate showing marked superiority over the others. An application of nitrogen, either in the form of sulphate of ammonia or dried blood, appears to have had no marked effect. The pronounced deficiency of these soils, as of nearly all those of our northern areas is clearly phosphoric acid. Attention might be called to the returns on plots 28 and 30. The application of the manure at a depth seems in this case to have produced better results than with the drill.

THE ELMORE–ECHUCA GROUP.

The returns from the Elmore district indicate appreciable and remunerative increases following the use of manures. The general yields, like those of all other parts of the State, are not high, but a good deal above the general average for the year. The superphosphate, especially in the medium dressing of 22 lbs. of concentrated (plot 3), or its equivalent quantity of 51 lbs. of ordinary (plot 6), has resulted in returns which seem to indicate that the principal manurial ingredient it contains (phosphoric acid) is the only one requiring immediate consideration in the soils of the district; and that applications below the maximum dressing of plot 4 might meet all requirements. Thomas Phosphate has in three cases out of the four failed to equal in effectiveness the more readily soluable form of the superphosphate, while in the fourth case there are indications which justify the opinion that the greater apparent effectiveness of Thomas Phosphate fails in sufficient guarantees of reliability. For there is no valid reason why 22 lbs. of concentrated superphosphate, used on plot 3 of Mr. Pook's field, should give an increase of 4·83 bushels, and its equivalent quantity in the ordinary form on plot 6, 2·83 bushels. Nitrogen manuring, with the exception of Mr. Grogan's field, has no where shown an increase sufficiently marked to excite attention. In Mr. Grogan's case there has been an appreciable increase, due apparently to the addition of nitrogen, as evident in the returns of plots 10 and 12. The returns right through of this field are remarkable for their very large increases, and I fail to understand Mr. Grogan's comments in sending in returns. He writes :—"I do not regard the test a good one, as the plots were sown just before the day's rain, which was not sufficient to bring all the grain through at once. It came up patchy." The returns on plots 16 and 18 cannot, owing to certain reasons, be taken into consideration. The returns from the Echuca field requires no special comment.

DAIRYING.

A SMALL DAIRY FARM.

By R. T. Archer.

The following account of the small dairy farm of Mr. George Hollier, of Trafalgar, affords an illustration of what can be done in this direction under a proper system of management.

The property consists of 20 acres of rich grey flats, once heavily timbered, but now cleared and subdivided into eight small paddocks. This latter proceeding is of the utmost importance in dairying, since the cows may be changed from one paddock to another, and are always able to procure fresh, sweet grass. A week at a time is quite long enough for cows to run on these small paddocks, as by that time the grass becomes soiled and distasteful. Frequent change of pasture in this way will be found to have a most beneficial effect on the cows, and they will milk much better. This can easily be proved by the application of the scales.

"Cow grass" (one of the clovers) is the most favoured herbage. The land is ploughed and sown, and if after a few years signs of running out are shown, the paddocks are broken up and re-sown. Water is pumped from a dam, and the stock watered from a trough. The splendid condition of the cows at the time of my visit testifies to the skilful manner in which the work on this little holding is done.

The stock consists of six cows, Shorthorn and Ayrshire cross, four head of young stock, and one horse, the only feed given besides grass being the clover hay, grown on the place.

The milk from each cow is weighed regularly, morning and evening, and carefully recorded. For this purpose a spring-balance hangs in a convenient place, and close by, a ruled sheet of paper with the names of the cows, and on this the weight of milk is registered. For the season 1900 and 1901—

Pansy ...	... gave 821	gallons of	milk and tested	4·8
Queenie ...	... " 760	"	"	4·4
Maud ...	... " 934	"	"	4·3
Strawberry	... " 759	"	"	4·2
Lily ...	... " 615	"	"	4·5
Mousey ...	... " 950	"	"	4·1
Total	... 4,839 gallons.			

The milk was supplied to the Sunny Creek Creamery, a branch of the Trafalgar Co-operative Butter Factory, and the following are the particulars of the returns :—

—	Gallons.	Test.	Butter.			Value.		
				s.	*d.*	£	*s.*	*d.*
September 10th ...	57½	4·5	29½ lbs. @	0	8¼ =	1	0	3
October 8th ...	317½	4·0	144 ,,	0	7¾ =	4	13	7
November 5th ...	397	3·9	176 ,,	0	7½ =	5	10	6
December 3rd ...	512	3·8	222 ,,	0	9 =	6	18	9
December 31st ...	503	3·9	224 ,,	0	7¼ =	6	15	4
January	646	3·8	280 ,,	0	8 =	12	0	0
February	568	3·9	243 ,,	0	9 =	9	2	7
March	536	4·1	244 ,,	0	11 =	11	4	0
April	486	4·2	227 ,,	0	11¾ =	11	2	9
May	365	4·3	175 ,,	1	0 =	8	15	3
June	151	4·5	76 ,,	1	1 =	4	2	6
July	71	4·7	37 ,,	1	2 =	2	4	9
August	26	4·8	14 ,,	1	0 =	0	14	0
	4,636		2,091½			£84	4	3
			Bonus ...			4	8	8
						£88	12	11

This gives an average of £14 15s. 5d. per cow. About 90 per cent. of the milk was returned after separation, and this was fed to calves and pigs.

13 pigs were sold fat for	£26 4 6
Calves sold	2 10 0
	£28 14 6

It was estimated that the skim milk was worth £4 per head, and this would leave £4 14s. 6d. for pig feed.

It will be noticed that the difference between the amount of milk sent to the creamery and that taken from the cows was 203 gallons, which would be used at home. This at 4·58d. per gallon = £3 17s. 6d., or 12s. 11d. per cow, making altogether £19 8s. 4d. per cow.

The highest returns for each cow for any single week are here given—

Mousey ...	321½ lbs. of milk,	which at 3·8	= 13·3	lbs. butter.
Maud ..	315½ ,,	,,	= 13·1	,,
Pansy ...	306 ,,	,,	= 12·8	,,
Strawberry ...	302½ ,,	,,	= 12·6	,,
Queenie ...	296½ ,,	,,	= 12·3	,,
Lillie ...	279½	,,	= 11·6	,,

In the above table I have taken the test at 3·8, assuming that when the flow was the greatest the test would be the lowest, and it will be seen that the highest return was only 13·3 lbs. of butter. There is nothing extraordinary about this, and there is no reason why it should not be achieved in any herd by judicious management.

In the season 1898 and 1899 eight cows were milked.

Splodgy gave	... 849	gallons.
Queenie ,, ...	... 752	,,
Maud ,, ...	... 760	,,
Lily (her first calf) gave ...	... 526	,,
Mousey gave	... 1,159	,,
Kitty ,, ...	... 592	,,
Snowy ,, ...	... 716	,,
Ginger ,, ...	... 936	,,
Total ...	... 6,290	,,

Mousey, although she gave 1,159 gallons, was lying down six weeks with a lame leg, and it was three months before she could walk.

The dairy farmer should always know which cows are paying for the food they eat, and which are not, and the only way to find that out is by the use of the scales and the Babcock tester. When that is determined, those which are not giving sufficient return should be spayed and fattened, or sold to some one else to fatten, and there will be all the more grass for those that will turn it into butter.

A certain percentage of the food that a cow eats must go to keep up the animal heat, to create energy and repair the constant waste of tissue, and it is only after this has been provided for, that the surplus food eaten can be converted into milk, hence the necessity of the animal having abundance of food. There is no fear of them eating more than they can turn to profitable account, if fed regularly. One great point to be remembered is never allow the animal to get low in condition. A reserve of food must be provided if a success is to be made of the business. How often do we see cows turned out for the winter to shift for themselves, and come in in the spring little more than walking skeletons. Half the season is spent in getting into condition before they can give much milk, and by that time the grass is dry, and without a full supply of succulent food they cannot make milk.

It is pleasing to see so many adopting the system of rugging the cows in rough weather, as this one means of preventing the waste of food that is necessary to keep up the heat of the body.

VITICULTURE.

SEASONABLE WORK IN THE CELLAR AND VINEYARD.

By R. Dubois, B.Sc.

JULY.

Cellar.

Casks containing new wines should be carefully filled up once a week.

Bung cloths should be renewed once a month during the first year.

If the bung holes are perfectly rounded with the *boudonnière* (bung-hole rasp) to get rid of jagged edges, and if long bungs carefully turned are used it is not necessary to use bung cloths. This offers greater security, as bung cloths moistened with wine soon become acetic—glass bungs are still safer.

Begin fining old wines which are sufficiently matured for sale. These wines may be bottled this month. Chose for these operations a bright, dry, calm day.

It is at this period of the year (corresponding to January in Europe) that light and diseased wines are frozen in Burgundy. In Victoria this treatment should only apply to Geelong and Lilydale wines, as the full-bodied wines of the north cannot be improved by it.

Vineyard.

Continue digging and manuring as explained last month.

Continue pruning and layering.

Finish the pruning as early as possible, to allow winter ploughing to be done. This is the most important ploughing of the year, and cannot be too thoroughly performed. Its main object is to aerate the soil, and also to allow rain water to soak into the subsoil. It should be done to a depth of eight inches.

It is also a very good plan to subsoil every other ro , so that the treatment might not be too severe, keeping two feet away from the vines. This will destroy part of the fibrous roots, but the vines will very quickly form a new root system in the mellowed subsoil during spring. The following year the untreated rows may be subsoiled in this way. The object of this operation is to do away with the plough-sole, always to be found in vineyards cultivated year after year to the same depth.

Where vines are irrigated and not trellised, as in Mildura, Ardmona, &c., it is advisable to subsoil in the opposite way to which vines are irrigated.

We are aften surprised to see the difference in the growth of two adjoining vineyards. Some yielding prolific crops, while others are scarcely worth gathering, the soil and climate being practically identical. This difference is generally traceable to a difference in *cultivation*.

Vine canes should be burnt on the land in a travelling fire-box (incinerator), so as to evenly spread the ashes containing valuable potassic fertilizer on the whole surface of the vineyard.

When pruning, remove wood affected by anthracnosis or hail, or wood not properly ripened. You will often notice that after a frosty spring large swellings (called *broussin* in French and *black-knot* in English) develop on the collar and main roots of the vine. If left on the plant they will injure its future growth. It is therefore imperative to remove them. This is done by shaving them off with a strong pruning knife.

Uproot vines affected by *pourridié*, and treat soil with copper sulphate (bluestone).

Prepare beds for nursery of American vines where required. Prepare mulching and long manure for same.

Prepare stocks and scions as indicated last month. Graft on the bench (indoors) rootlings and cuttings of phylloxera proof stocks, and place grafts in damp, clean river sand to callus. The callusing beds should be established against a wall facing east, on well drained ground and sheltered from rain by a light roofing of galvanized iron.

Rootlings may be planted out this month where the soil is not too wet and sour. Cuttings will do better if planted in August. Cuttings, however, should be prepared and stratified, as they will strike better than if planted directly after they are cut. This also applies to grafted cuttings.

AUGUST.

Cellar.

Keep casks containing new wines well filled up, as explained last month.

Proceed this month with the second normal racking, which must be finished before the equinox of spring. Pumps, hoses, syphons, tubs, buckets, &c., should be cleaned with boiling water before being used for this operation. Choose a bright, clear day.

When racking is over, arrange the casks in the definite position they are to occupy in the cellar, with their bungs sideways, so as to be completely wetted by the wine inside. Towards the end of the month, after the second racking is over, clean the cellar thoroughly and whitewash the walls with quicklime.

Continue the fining and bottling of old wines. Great care should be taken to maintain the temperature of the cellar low and constant, as if it is allowed to rise (under the influence of north winds) before second racking is over a slight fermentation will take place, which will cause the lees to rise and the good effect of the racking to be lost.

VINEYARD.

Continue winter ploughing, bench grafting, and callusing as during last month. Finish pruning as quickly as possible, if it is not already completed.

Apply winter treatment against anthracnosis where the disease has been prevalent.

Foëx recommends the following treatment :—Swabbing the stumps after pruning is over with a concentrated solution of sulphate of iron. This destroys the greater part of the winter spores of the fungus. The solution is prepared in the following manner :—Take 1 cwt. of sulphate of iron, wet it with a quart of sulphuric acid. After mixing thoroughly, dissolve into 25 gallons of warm water.

Continue layering where necessary.

Drive stakes when winter ploughing is over.

Place cuttings in the nursery for next year's plantation, or plant out for the establishment of the vineyard. If cuttings have been previously stratified and developed water shoots, these should be removed before planting. Grafting of old stock should be started this month north of the Dividing Range.

VINEGAR MANUFACTURE BASED ON PASTEUR'S DISCOVERIES.

By Emile Claudon.

*Translated by R. Dubois.**

CHAPTER I.

Methods in use at the Present Time.

I.—General Considerations.

As the history of vinegar making is of no practical industrial interest, we will not consider it. It has doubtless been produced since the highest antiquity, for, wherever the juice of sweet fruit existed, *alcoholic* and subsequently *acetic* fermentation, must have taken place.

When these liquids became a necessity of every day life, men endeavoured to obtain the most favorable conditions for their abundant and easy production. The manufacture of spirit and vinegar dates from that period.

We will not study the chemical composition of vinegar. Its acidity is due to the presence of *acetic acid*, which results from a modification of the alcohol of the liquid under the influence of air. We will only describe the methods of manufacturing; they are of more immediate interest.

We will briefly describe those used at the present day, and study the results of Pasteur's researches on *acetic fermentation*, which will certainly modify the methods now in use.

All methods are based on the oxidation of the spirit of alcoholic liquids in the presence of air. This kind of slow combustion takes away hydrogen from the alcohol to form water, and oxidizes the compound. The aim of the vinegar manufacturer should therefore be to obtain this oxidation under the most advantageous conditions of rapidity, economy, and quality.

Several methods are now in use. We must first mention the Orleans method and the German method, which are the oldest and the most generally used. Then come in order of date the methods of Singer, Vanderschmidt, Kœlitz, and Widemann, which after all are simply improvements on the German method, and finally, the platinum process.

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* A large amount of wine, specially light wines, turns and sours every year. The only market now open for this "off" wine is the large wine manufacturer, who buys it for extracting the spirit he requires for fortification, and pays from 6d. to 7d. per gallon. Truly it is not worth more as wine, but in many cases it is only acetic, that is to say on the way to making good vinegar, otherwise it is sound. As there is an open local market for good wine vinegar, vine-growers will derive great pecuniary gain from turning their sour wine into vinegar instead of selling it for distillation. This they can do at a very short notice and little cost, as will be seen from the following translation of Emile Claudon's *Fabrication du vinaigre fondée sur les études de M. Pasteur.*

Those who intend going in for vinegar-making will find in the following pages a clear study of the whole question. The vinegar yard must be established as far from the cellar as possible, as good wines are liable to become contaminated and sour.—R.D.

The latter methods are not extensively applied. Their installation and their working seems too costly to allow of them to become of general use.

II.—Orleans Method.

This method has been practised for a long time in the town of that name in Burgundy, and in almost all wine-producing countries, chiefly for the manufacture of wine vinegar.

The wine is filtered over beech shavings, damped with hot vinegar and placed in a hogshead. It is then mixed with vinegar, poured into hogsheads filled to two-thirds of their height only, and placed in a room where the temperature varies between 77° and 86° F. The heads of the casks are provided with bung-holes at about two-thirds of their height to facilitate the access of the air.

The casks generally used are ordinary hogsheads arranged in three rows one above the other to take less room.

About 2 gallons of wine are added to the vinegar contained in each hogshead, and the same quantity is added every week until about 10 gallons have been poured into each hogshead. Eight days after this operation a quantity of liquid equal to the quantity of wine added is taken from the cask. This liquid is pure vinegar. Then the operation is begun over again.

The casks used in the manufacture of vinegar are called *mother-casks.* The vinegar taken out of these mother-casks is filtered over beech shavings placed in an up-ended cask.

To start a mother-cask 30 gallons of vinegar, together with half-a-gallon of wine, are poured into it. A gallon of wine is added a week after, and the same quantity is added every week until the cask contains about 44 gallons. Half the quantity of the liquid is racked off after the whole of the liquid has been transformed into vinegar. This vinegar remaining in the cask is able to transform a further quantity of wine by using the method described above.

It takes about two and a half to three months for the mother-cask to yield regularly.

The mother-casks being prepared, and in working order, the quantity of vinegar yielded is about 8 to 9 gallons in 40 days, that is to say, about a quarter of a gallon per day, per hogshead, equivalent to about 0·48 per cent.

During the acetification of these 9 gallons of wine there is an evaporation of about 1 gallon of liquid, that is to say, about a quarter of a gallon between each operation which has to be added every time.

The cost of manufacturing reaches 2s. 6d. to 3s. per hogshead for a plant composed of 200 hogsheads.

III.—German Method.

The German method was invented by Vagemann and Schutzenbach, and is mainly used to transform the alcoholic must of barley or mixtures of spirit and water or beer into vinegar.

Large casks 6ft. 6in. in height and about 3 feet in diameter are placed vertically (Fig. 1). The top head is knocked off and replaced by a lid provided with a large hole. Six inches below that lid is a tray or false head made of wood and provided with a large number of conical holes, through which are passed pieces of string 6 inches long, provided with knots, which prevent them from falling into the vat and at the same time stop the holes incompletely. The space between the two heads is filled with beech shavings on a level with the lower extremities of the strings.

The operation is conducted in the following manner :—

The alcoholic liquid is poured above the false head, drips slowly along the strings and falls drop by drop on the beech shavings, which offer a very large surface to the oxidizing action of air. It acetifies, therefore, rapidly, falls into the bottom part of the cask, and is racked when there is a sufficient quantity collected.

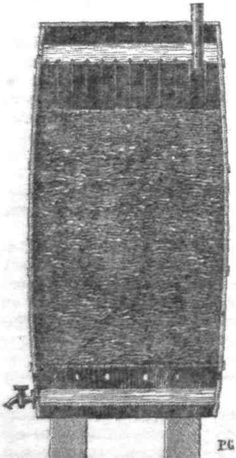
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Fig. 1.

The air travels in an opposite direction. It enters the row of holes made under the bottom false head, traverses the shavings, and comes out of the cask by the funnel fixed on the top false head.

The heat developing throughout the mass during the oxidation of the liquid helps the current of air to travel through.

The same liquid is passed several times over the shavings. Three times is generally sufficient for complete acetification.

Beech shavings are preferred to those of any other wood, as most chemists admit that they contain a nitrogenous matter, facilitating the absorption of oxygen by the alcoholic liquid.

As the presence of vinegar helps the transformation to take place, it is advisable to soak the shavings in vinegar before beginning the operation. The temperature should register 86° F., as in the Orleans process.

This appliance enables manufacturers to obtain vinegar in three days. Eleven gallons of alcoholic liquid are used, and this yields 3½ gallons of vinegar per day and per cask. These casks have a capacity of 330 gallons. The yield is, therefore, of 1 per cent. per day.

The loss in alcohol and acetic acid resulting from the large quantity of air circulating through the liquid is, in this case, much greater than with the Orleans process.

The cost of manufacturing does not exceed 1d. per gallon, and this figure might be reduced if the evaporation were diminished.

With the object of reducing labour, three casks are placed one above the other on three different levels, and the liquid runs from the top cask through the middle and the bottom ones. This saves the labour of pouring the liquid three times through the same cask.

IV.—Singer and Vanderschmidts Methods.

The two processes are almost similar, and may be described under the same heading.

Singer forces the alcoholic liquid to pass through a series of flat wooden vessels, superposed to each other and communicating by means of wooden tubes. These tubes are provided with a longitudinal slit, allowing the access of air. The liquid flows, drop by drop, from the top vessel into the second one. This brings the liquid in small particles in contact with the air and finally produces its complete oxidation.

This plant is placed in a building built specially for it, so as to prevent any lowering of temperature or any draughts. A current of air would cause a large evaporation of spirit, and the lowering of temperature would check the rapidity of acetification.

Instead of flat vessels, Vanderschmidt uses an inclined plane.

The liquid is stored in a vessel placed towards the top of the acetifying apparatus. This is composed of a kind of wooden case provided inside with a series of planes inclined alternately in inverse direction. The liquid runs from the storing vessel on the first plane, forming a very thin film. From the first plane it passes over the second, and so forth, to be finally collected at the bottom of the case and put through the apparatus again. This operation is repeated until the liquid is completely transformed into vinegar. For the acetification to be complete it requires a rather high temperature (86° F.) and a complete contact with the air, both conditions being conducive to a large evaporation of alcohol.

V.—Kœlitz Method.

This is based, like the German process, on the oxidation of the liquid running over beech shavings, the air being constantly renewed.

The appliances are a certain number of small conical vats 4 feet high, 4 feet in diameter at the top, and 4ft. 6in. at the bottom, each provided with a false head, upon which are placed four horizontal layers of beech shavings rolled spirally and pressed against each other.

Each layer is composed of about 48 rolls; the number of rolls in each vat is therefore about 672, offering a surface of contact with the air reckoned at about 4,780 square yards.

The alcoholic liquid is carried through wooden pipes in small vessels placed above each vat. A glass syphon carries it from that vessel in a funnel-shaped piece fixed above a horizontal wooden tube provided laterally with holes on opposite sides counting from the axis, and mounted on a silver pivot revolving on a glass socket. The liquid arriving in the tube from the funnel-shaped piece forces the system

to revolve after the fashion of a lawn-sprinkler, and divides it regularly in a fine spray all over the surface of the shavings. It takes two hours to travel through the fourteen layers of shavings, and when it reaches the bottom false head it is completely transformed into vinegar.

To increase the rapidity of the current of air, the following disposition is adopted. A wooden tube is fixed through the bottom head of each vat, and these tubes are in communication with a large funnel which draws the air. Alcoholic liquid of 25 per cent. proof spirit is mixed with an equal quantity of vinegar. During two hours 1½ gallons of this mixture are poured into the top vessel. The resulting vinegar contains about 10 per cent. of acetic acid, which is reduced 7½ per cent. by the addition of water.

This process is very quick, the yield being about 5 per cent. per day; but it is expensive, although less costly than the German process proper. The installation, working, and loss of alcohol by evaporation increases the cost of manufacture. The loss of alcohol by evaporation is, as a matter of fact, very large on account of the contact of the liquid with the air repeatedly renewed. The current of air is increased by two means—the heat developed during the transformation of the liquid inside the small vats, and by the drawing chimney.

VI.—Widemann Method.

Widemann uses ozone for the oxidation of the alcoholic liquid, according to a paper he sent in August, 1872, to the Academie des Sciences. The factory which he established in the United States at White Plains started working on the 20th April, 1871. It produced 30 quarter-casks of vinegar per day, which were immediately used for the manufacturing of pickles. "When I left New York in January, 1872," says Widemann, "the factory was in full prosperity, and the production of vinegar per day reached 90 quarter-casks of 40 gallons each, or 3,600 gallons per day." It is well known that ozone (peculiar state of the oxygen of the air during storms, attributed to the effects of electricity) has a most powerful oxidizing action, as it can oxidize silver and bodies which are not affected by the most oxidizing compounds. It would therefore oxidize alcohol and transform it into acetic acid; but the cost of production of ozone is too great to enable the use of this body for the manufacture of vinegar.

Widemann made experiments with his process at Baron Thenard's place. The result of the experiment was the complete transformation of the wine into vinegar. The following is the mode of operating:—

The alcoholic liquid is poured into the top of a cylinder containing small fragments of glass and porcelain, through which it drips drop by drop. The air is forced through a blow-pipe in the flame of a gas-burner placed near the hole provided in the bottom part of the cylinder. The impulse given to the air by the blow-pipe and by the heat it acquires through the burning gas is still increased by a strong draught funnel. This air, projected, heated, and drawn in this manner,

travels through the cylinder, where it comes into contact with the alcoholic liquid descending through it. The acetification takes place more or less rapidly.

Is it really ozone which has been produced under these conditions, and which transforms the wine into vinegar?

We made experiments with alcoholic liquid and wine at Baron Thenard's place with ozonized oxygen (containing 40 metres of ozone per litre, that is to say, very strong), which Thenard very kindly produced with his ingenious apparatus; and I must say that the results obtained with that ozonized oxygen were not as decided and as satisfactory, from the point of view of acetification, as those obtained by Widemann with his air heated through a gas-burner.

Widemann's process is, therefore, nothing more or less than an improvement on the German process.

However, this method of manufacture can but be very costly. Installation, working, loss by evaporation, naturally increased by the hot air, and its rate of motion, seem to be all conditions increasing the cost.

VII.—Process with Platinum Black.

This is the industrial application of the property possessed by platinum black, of absorbing the oxygen of the air in its pores, and of yielding it afterwards to the alcohol in contact with it in sufficient proportions to transform that alcohol into acetic acid.

Experiments on the application of this reaction were undertaken in Germany.

The best machine at present in use is composed of a glass case containing shelves upon which are placed porcelain capsules. These capsules contain a tripod made of porcelain, upon which is placed a watch-glass containing the platinum black. On the top and bottom of the glass case are openings which may be regulated. The gauge can also be heated by steam when the surrounding temperature is too low.

The alcohol is placed in the capsules, and the watch-glasses filled with platinum black. The temperature inside the case is brought up to 86° F. The alcohol then begins evaporating slowly, the vapours come in contact with the platinum black, which yields the oxygen it absorbed from the air, transforming it into acetic vapours. These condense on the walls of the box, and are collected at the bottom in a vessel provided for that purpose.

This reaction takes place as long as the oxygen of the air is not completely absorbed. It is therefore necessary to renew the air to allow the phenomenon to take place without interruption. This ventilation takes place through the holes provided at the top and bottom of the case, and which are open so as to allow the current of ai. to take place under the most favorable considerations.

For each cubic metre, this device requires 400 grammes of platinum black, a quantity sufficient to transform from three to four litres of alcohol into acetic acid per day.

The cases now in use vary in size. Some patterns contain as much as 40 cubic metres.

This method does not allow the manufacture of a sufficient quantity of acetic acid, and further, if the ventilation is not sufficient, part of the alcohol is transformed into aldehyde. If the ventilation is increased, part of the acetic acid is lost by evaporation. This process should therefore be discarded.

VIII.—Properties of Acetification of Different Liquids.

Before studying Pasteur's work, we are going to lay down a few general principles on the properties of acetification of the different liquids generally used in the manufacture of vinegar. These are based on a number of practical observations, and may serve as guides, although they are not all of equal value.

1st. No alcoholic mixture, no musts specially prepared to be transformed into vinegar are ever equal to wine, which always produces vinegar of higher qualities. Wine is a liquid pre-eminently fitted for making vinegar.

2nd. White wines acetify quicker than red wines. This is attributed to their greater richness in nitrogenous matters.

3rd. New wines do not acetify as readily as old wines, for they yet contain saccharoid matters

4th. Wines lose their mouldy taste when transformed into vinegar, while, on the contrary, the lactic *pousse* and *tourne* taste persist in the vinegar.

5th. The liquid extracted from fermented marc is eminently fit for making vinegar. A large quantity of vinegar is manufactured in this manner in the south of France.

The marc of red grapes is generally more alcoholic than that of white grapes. This is due to the different systems used in the manufacture of these wines.

The marc may be preserved for a whole year in tanks constructed with bricks and hydraulic lime, by ramming it in these tanks and covering it with mortar made of pure clay.

To use the marc to its greatest advantage, one gallon of water is added to every gallon of marc, and heated to 86° or 104° F. The marc is thoroughly mixed with the water, and left in a tank for 12 hours, during which it absorbs it. The next day the marc is pressed, and the water extracted from that marc contains the alcohol and the acetic acid (process recommended by Savalle).

6th. In Germany and England, vinegar is made out of malt fermented in the same way as for making beer. It is filtered before using.

7th. The juice of plants containing sugar, such as cane sugar, sweet sorghum, maize, beetroot, Spanish potato, rock melon, &c., may be submitted to an alcoholic fermentation, and therefore turned into vinegar.

IX.—Acetic Titre of Vinegar.

The strength of the vinegar is ascertained by using a kind of graduated aërometer called *acetimetre*. The indications of this instrument are not very reliable, as the specific gravity of acetic acid does not differ much from that of water.

More reliable information is gained by saturating the acid.

Alkaline carbonates, such as chalk, carbonate of potash, soda, &c., are used for that purpose. As a rule 100 parts of good vinegar of Orleans are saturated by 8 grammes of chalk, 8·5 grammes of carbonate of potash, or 6·5 grammes of carbonate of soda.

The average acetic titre of good vinegar of Orleans varies between 7 and 7·5 grammes in weight.

Reveil and Salleron propose the use of a titrated alkaline solution for ascertaining the acetic titre of vinegar. This solution is composed of 45 grammes of borate of soda (pure) and 11 grammes of caustic soda (pure) dissolved in 1 litre of distilled water, and coloured blue by the addition of a few drops of lithmus. The instruments used in the reaction are—1st. A graduated glass tube called acetimetre, which is filled with the vinegar up to 0, the graduations counting upwards; 2nd. A pipette, which is used to pour the alkaline liquor into the graduated tube drop by drop.

When the colour of the mixture begins to turn violet the addition of the acetimetric liquor is stopped. A division corresponding to the level of the mixture in the tube indicates by direct reading the quantity of pure acetic acid contained in 1 c.c. of vinegar. This method has been adopted by the *octrois* of a few towns.

CHAPTER II.

Pasteur's Studies on Acetification Phenomena.

I.—Chemical Nature of the Transformation of Wine into Vinegar.

Pasteur experimentally proved—

1st. That the presence of air is an indispensable condition for the transformation of wine into vinegar.

2nd. That, when the wine is transformed into vinegar, the alcohol of that wine is replaced by a matter of a totally different nature, called acetic acid.

3rd. That this transformation is the result of the fixation of the oxygen of the air on the alcohol of the wine; vinegar is therefore the result of oxidation, or in other words, slow combustion.

The following table gives the composition of alcohol a .d acetic acid for 100 parts in weight:—

	Alcohol.	Acetic Acid.
Carbon ...	52·18	40·00
Hydrogen ...	13·04	6·67
Oxygen ...	34·78	53·33
	100·00	100·00

There is also the production of a certain quantity of water. For instance, 46 parts by weight of alcohol combined with 32 parts of oxygen yield 60 parts of acetic acid and 18 parts of water.

From this, it results that a wine containing 17·29 per cent. of proof spirit at 60° F. (7·93 by weight) would furnish vinegar containing 10·36 grammes of acetic acid.

Roughly, the volume of alcohol contained in the wine is equivalent to the weight of acetic acid produced.

4th. That alcohol diluted in pure water and brought down to the same strength as wine and exposed to the air, is not transformed into vinegar. This would mean that there is in the wine something which helps the reaction (nitrogenous matter).

5th. That this transformation of wine into vinegar is nothing more or less than a phenomenon of fermentation. It is not due, as Fabroni said, to the presence in the wine of an albumenoid matter called vegeto-animal principle, which, in contact with the air becomes a ferment, but to the action of a real, small, and simple plant, a kind of fungus named *Mycoderma aceti* by Persoon in 1822, and commonly called "Mother of vinegar." This fungus is formed of segments more or less constricted, having the shape of granulations and joined together by a mucilaginous matter almost invisible under the microscope.

6th. That whenever wine is transformed into vinegar, this *Mycoderma* is present, although sometimes difficult to detect. Pasteur proved that the cause of the reaction is due to the *Mycoderma*, and not to the albumenoid matter. Wine heated in a sealed glass vessel containing air never becomes acetic, yet the albumenoid matter has not been destroyed by heating and its properties were not altered, for if the vessel were to be opened again acetic fermentation would start. A mixture of alcohol and pure water without any albumenoid matter can acetify if an alkaline crystallizable substance (alkaline phosphates and true phosphates mixed with phosphate of ammonia) is added to it, as it will allow the *Mycoderma* to develop.

However, although the albumenoid matter contained in the wine is not the cause of acetification, it is the food, the indispensable nitrogenous food, of the microbe.

II.—Phenomena Accompanying the Acetification of Wine.

The transformation of wine into vinegar is always accompanied by the development of the *Mycoderma aceti* forming a fine film on the surface of the liquid, which has a more or less greasy appearance. This microbe has the property of absorbing large quantities of oxygen, and of fixing it on the alcohol of the wine. It finds in the wine the albumenoid matters necessary to its life. The phosphates of magnesia and potash help its development, as the wine is already rendered more acid by the addition of acetic acid (the microbe develops better in an acid surrounding), and as its temperature is brought up to 59° or 68° F.

Mycoderma aceti is generally preceded by the development of *Mycoderma vini*, formed of budding cells, which multiply better in a sound wine, and do not develop at all when the wine becomes acetic.

It is easy to make vinegar based on these data, by mixing wine and vinegar, and sowing on the surface of the mixture, *Mycoderma aceti*, taken from the film covering the liquid of another cask. In 48 hours the surface of the mixture is completely covered with *Mycoderma*, and in a few days the mixture will be transformed into pure vinegar.

To obtain *Mycoderma aceti* the first time all that is required, is to leave a mixture of wine and vinegar in a warm room with the surface exposed to the air. The germs of the *Mycoderma* being disseminated everywhere, it will not take very long for the surface of the liquid to get covered with a film of microbes.

III.—Diseases of Vinegar.

Masses of mucous membrane of a gelatinous aspect often form in the vinegar. It is *Mycoderma aceti* in a peculiar stage of development, which instead of forming a film on the surface of the liquid, becomes submerged and checks the acetification phenomena. The presence of these mucous masses is always a proof that something has gone wrong.

The vinegar often becomes cloudy, its strength diminishes, and it becomes putrified. These alterations are caused by the microbes which (all the alcohol being transformed into acetic acid) drop to the bottom of the vessel and continue their oxidizing properties upon the acetic acid, which is decomposed into water and carbonic acid gas. It is a veritable combustion.

It is essential to ascertain exactly the alcoholic strength of the wine before the beginning of the phenomena, so as to know the acetic strength of the vinegar to be made, and stop the reaction directly all the alcohol is transformed. If this super-oxidation is allowed to take place, the bouquet of the vinegar disappears and the liquid is invaded by the microbes of putrefaction.

Vinegar often contains small animalculæ with transparent bodies (which allows us to distinguish their internal organs), called "vinegar-eels."* They were at first considered useful for the manufacture of vinegar; but they are, on the contrary, very detrimental, for as they cannot live out of contact with the air, they remain on the surface of the liquid, preventing the regular development of the *Mycoderma*. These two organisms are always in opposition in their development, fighting each other. When the *Mycoderma* gets the best of it the "vinegar-eels" are driven against the sides of the vessel, where they form a whitish ring, only awaiting the weakening of their enemy to resume their former place.

The only means of preventing their development is cleanliness. The tanks and casks used in the manufacture of vinegar must be often and carefully cleaned. Filtering and fining also serve as a means of getting rid of vinegar-eels.

* Popular name for Nematoda.

Pasteur having discovered that all the vegetables and animals living in wine and vinegar die at a temperature of 131° F., recommended the heating of vinegar to that temperature, to check the above-mentioned disease. He prefers heating machines in which the heated liquid is not cooled, so as to have it delivered in the casks warm, and thus destroy the germs which might be contained in these casks.

To preserve vinegar it is essential to keep the casks constantly full.

IV.—Rational Method of Manufacturing.

Pasteur was induced by his studies on acetification to try and find a more rational industrial method of manufacturing, based on the new scientific principles he had discovered. He operated on a tank 1 square metre in surface, and 20 centimetres in depth, provided with a lid and an opening at each extremity to allow a current of air to take place. This tank contained from 50 to 60 litres of liquid, and produced from 5 to 6 litres of vinegar per day. Breton Lorion, vinegar manufacturer at Orleans, obtained the same results with his manufacturing plant based on Pasteur's discoveries.

If wine is used it is mixed with vinegar, and the surface is sown with *Mycoderma* taken from a tank which has already fermented for 48 hours, or from a small tank specially provided for the purpose, adding as many square inches as there are square feet in the tank.

At a temperature of 60° F. two or three days are sufficient, if the microbes are young, for the *Mycoderma* to cover the whole surface of the liquid, whatever dimensions the tank may have.

For a continuous operation the microbe must be renewed after a few days, when it becomes too old. This can be easily recognised, as it is seen under the microscope in the shape of granulations instead of long chaplets of segments. A new start is then necessary.

This mode of operating also applies to beer or any fermented grain, must containing natural phosphates and albumenoid matters.

If alcoholized water is used it is indispensable to add phosphate of ammonia, phosphate of magnesia, and a small quantity of albumenoid matters furnishing the nitrogen, or barley water containing carbon and phosphates in a more assimilable form, &c. However, liquids naturally containing substances necessary to the development of the *Mycoderma aceti* should always be preferred.

The operation with alcoholized water consists in mixing 2 per cent. of alcohol, 1 per cent. of acetic acid, and a few thousandths of phosphates, sowing with *Mycoderma*, which soon covers the whole surface. Directly half the alcohol is transformed into acetic acid, a small proportion of alcohol is added every day until the required acetic strength of the vinegar is reached. When the acetification is completed the vinegar is racked, keeping the microbe film apart for further use. The larger the tanks the better the result.

It is essential to keep the microbe always well provided with alcohol, as it would naturally react on the acetic acid, and would not resume its acetifying action, even if alcohol were added afterwards.

It is also advisable not to force the too rapid development of the young plant. Its increased activity would result in an action on the acetic acid, although the liquid contains alcohol.

Pasteur sums up the advantages of his process as follows :—

Use of covered tanks, therefore reduced evaporation ;

Complete command of the manufacturing process ;

Presence of "vinegar-eels" avoided ;

Method three to five times more rapid than those now in use, therefore diminution of the cost of manufacture.

(*To be continued.*)

HORTICULTURE.

THE EXPORT OF FRUIT PULP.

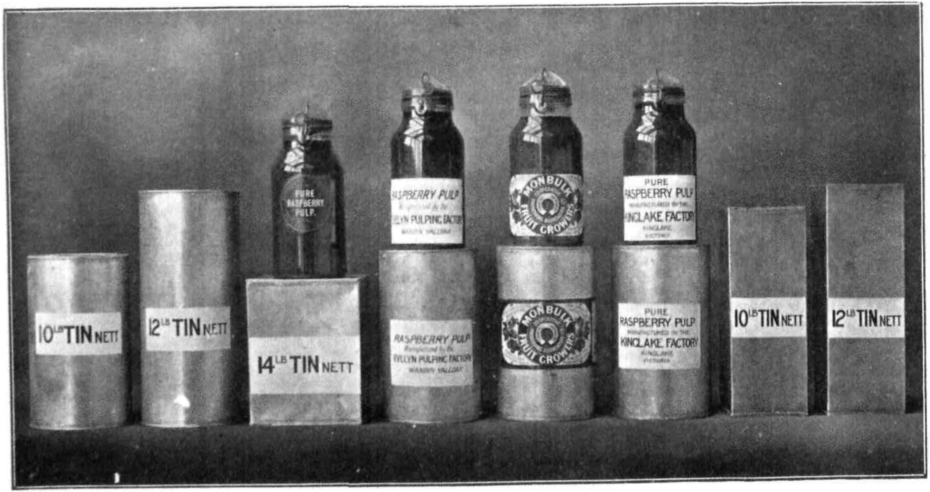
By J. Knight.

Some few years ago it was found that the increased production of certain soft fruits was such as to leave no possible chance of disposal in this State, and so supply exceeding demand, the price fell below that which was remunerative, and serious complaints were made by the producer. These were directed against the Government in the first place, for inducing persons to enter into fruit production, and also against the manufacturer for taking advantage of this over-production to cut down prices to what was termed a ruinous level. However, the factories were in an equally unfortunate position, as their market was limited, and competition amongst themselves became so keen that their trade was by no means all that could be desired. They then had to exploit outside markets at considerable expense and risk. Some made shipments of pulp to England, but generally with unremunerative results, considering the price paid for the fresh fruit. As a consequence, growers were left to their own resources, and in some instances orchards where soft fruits were grown passed out of cultivation. The Government was then appealed to for assistance in developing the export trade in pulp, and a liberal response was made. A bonus of one half-penny per lb. was granted upon all apricot and raspberry pulp shipped to ports outside the Commonwealth.

Raspberry Pulp..

It was unfortunate that the raspberry-growers would not act on the advice given as to the methods of packing and size of tins to be employed. On the score of economy, they put up their fruit in 45-lb. tins, a size not recognised on the London market. This, however, was not the only drawback to the use of the large tins; they were not strong enough to withstand the rough usage to which they were subjected, a large percentage became leaky and fermented, depreciating the value of the sound tins. It is not to be wondered at that the venture was not financially successful. Repeated warnings have been given by Mr. Sinclair and others, but the large tins have been used up to the present. Sample tins have been exhibited to show the methods adopted in other countries, and the 10-lb. tin advocated. The saving in initial cost of the large 45-lb. tins is about £2 per ton, with a slight addition for the extra cost of tinning in the smaller sizes. The practice in the London market by a certain class in the trade is to purchase in 10-lb. tins only, and for these the price runs up to £4 and £5 per ton above that in the large packages. It will thus be seen that the use of large tins is in reality false economy, for not only is a lesser price obtained for the pulp, but much heavier losses occur in transit.

The late Minister of Agriculture has directed that samples of raspberry pulp be purchased, packed in 10-lb. tins and in glass jars, for



SAMPLE PACKAGES OF FRUIT PULP.

purposes of exhibition, and with a view to the development of an inter-State trade in this line; but, unfortunately, this year's product is all put up in the large tins.

The styles of packages adopted by the four co-operative factories which have been brought into existence during the past season are shown in the photograph reproduced. The 10-lb. tin is the one specially recommended for the export trade. The round 12-lb. tin shows the full size of the plate from which the tin is made. The 14-lb. is employed by one company to a very limited extent, and is designed to contain 14 lbs., because the bucket of raspberries as usually marketed in the city holds this quantity. This has no advantage over the 10-lb. beyond a slight saving in cost, and, in my opinion, should not be encouraged. The practice in London is to look for high-class pulp in 10-lb. tins, and that trade alone is worth catering for. This package is equally suitable for the local market, as it would enable hotels and restaurants to use fresh raspberries throughout the year, instead of, as now, being limited to five or six weeks; thus the local demand would be considerably extended. The larger-sized tins cannot be used by them without loss, as fermentation sets in soon after opening. The 10-lb. square tin shown in the plate is employed by one firm only, who speak highly of it; but the objection raised to it is the extra cost of making. The only advantage gained, so far as I have seen, is in the packing, as it occupies less space—a consideration when shipping. Its solidity also prevents damage by the ships' slings when loading and unloading. Whatever the type of package used, this is certain: that, if we establish a market in London or elsewhere, we must recognise the trade practice, and adopt the 10-lb. tin, and cater for the high-grade price, as no other will pay the Victorian grower.

Apricot Pulp.

In regard to apricot pulp, the shipments have always been put up in the approved tins, and, where the sterilizing has been properly done, they have arrived in good condition. The pulping of this fruit is much more difficult than that of the raspberry, as it is necessary to sterilize without destroying the form of the fruit. The prospect of establishing a trade with London is not hopeful as far as apricot pulp is concerned, for the cost of placing it on the market is not less than £13 per ton, and the margin between this and the present price—£14 to £15 per ton—leaves little or nothing to the growers. As uming the continuance of present prices, it may be said that, unless the cost of tins, the work of pulping, and the freight charges can be considerably reduced, there is no chance of developing a payable export trade. The export of fruit in any form means competition with the world; and if we are not able to accept the world's prices we had better not enter into the business. The best article only should be shipped, and put up in the best possible form.

The following figures relating to a consignment of 1,240 cases of apricot pulp sent to London from the Goulburn Valley in 1901 will make clear what has been said as to the prospects of this trade. A total of 63 tons 9 cwt. of fruit was pulped, at a cost of £2 per ton for labour alone,

The 1,240 cases cost 1s. 5d. each, and the 12,400 tins 6¼d. each. The other charges, freight, commission, &c., brought up the total to £833. Though the pulp was of fine quality, the gross receipts, exclusive of bonus, were only £875, leaving about 16s. 5d. per ton of fruit, a sum insufficient to pay the cost of growing. Even with the bonus, the net return was less than £5 per ton of fruit. It is generally considered that about £6 to £7 per ton is the lowest figure at which apricot growing can be made to pay, hence the results of the shipment here considered offer little encouragement to persevere; though, of course, a rise in the London price might make the trade profitable. This is, perhaps, not impossible, as the figure obtained was said to be abnormally low, owing to the heavy crops on the Continent.

General Considerations.

Frequent complaints have been made by Mr. Sinclair, which have gained publicity in the press, as to the poor condition of some of the shipments on arrival in London. This has been wrongly attributed to defective sterilization. No shipments are sent forward until a month or more after manufacture. As an additional precaution after the journey from the factory to the city, the pulp is detained for fourteen days to allow any fermentation to show itself, which may arise from damage to the tins on the road down. Each package is examined before shipment, and any showing the least defect is rejected. No more stringent precautions can be taken, and the remedy lies with those in the trade—the shippers and those financing them—to see that only approved tins are employed. In this way alone is it possible to insure the arrival in good order of future consignments.

VICTORIAN FRUIT IN LONDON.

Mr. J. M. Sinclair, the Government Agent in London, furnishes reports upon the consignments of fruit arriving by the *Omrah*, *Orestes*, and *Oceana*.

"The apples, pears, and grapes from Victoria, ex *Omrah*, were sold at Covent Garden. Although reported by the engineer of the steamer that the fruit was carried at a temperature of 43 deg., some of it appeared to be in an over ripe condition. The Tasmanian shipment was complained of by salesmen as showing indications of being affected through high temperature, and the low range of prices obtained for it —from 7s. 6d. to 9s. 6d. per case—was stated to be chiefly due to its condition from this cause. Prices all round for apples, even the finest in sound condition, ruled lower than at previous sales this season, the range for Victorian being influenced by the lower rates accepted for Tasmanian. For the Victorian grapes from 10s. 6d. to 14s. 6d. per case was realized. For pears, the Vicar of Winkfield variety sold at 12s., 14s., 16s., and 18s. 6d. per case according to quality and condition. One case of large St. Germains realized 30s. The latter were magnificent fruit in perfect condition. The case in which they were packed had a division through the centre, the pears in two layers being packed in cork dust. The price obtained indicates the value readily paid for pears of excellent variety and condition at this season of the year. Of apples the principal varieties and the prices realised for them are as follows :—

Jonathan	10s. 6d. to 14s.
Cleopatra	12s. 6d. to 13s. 6d.
Dumelow's Seedling	12s. 6d.
Munro's Favorite	11s. 6d. to 12s. 6d.
Rymer	8s. to 8s. 6d.
Spitzenberg	8s. to 8s. 6d.
Scarlet Pearmain...	9s.
Sturmer	9s. 3d.
Five Crown	8s. to 9s.

"Some of the Majetin variety were reported to be in bad condition, the fruit having a dark yellow scalded appearance as if it had been exposed to a hot sun after pulling and prior to shipment and realized only 3s. 6d. per case.

"Complaints are made of the presence of apples affected with 'black spot,'* and codlin moth was found in some consignments. Those with 'black spot'* having a sort of dry rot extending into the centre of the apple, are quickly noticed by buyers purchasing fruit at the auction sales at Covent Garden. If only two or three apples affected with this

* In this report, the Black Spot is evidently confused with the Bitter Pit. The description given of the affected fruits indicates at once to any one familiar with these two diseases that it was Bitter Pit that caused the trouble. The varieties subject to this disease should not be packed until at least a week after picking, as this will permit the disease to show itself in the great majority of instances.

disease are noticed in one of the sample cases submitted at the sale, the value of that variety under its mark on the boxes is at once reduced. Growers should therefore be careful not to pack any apples blemished with this disease.

"*Tasmanian pears ex 'Medic.'*—A consignment of 420 'trays' of pears from Tasmania per *Medic*, sold at Covent Garden last week, shows that this fruit can be carried in sound condition, and will meet with a ready sale at high prices. These pears—twelve varieties—were packed in shallow cases, containing only one layer of fruit. After packing, the 'trays' or cases were closed, three were placed together and held in this way by cleats nailed at the sides. They were shipped in this way and arrived in perfect condition. Each 'tray' would not contain half an ordinary case of fruit, so that the prices realized as follows, would be very profitable to the shippers :—

306	trays	Bon Cure	7s. 3d.
6	,,	Beurré Bosc	20s.
2	,,	Beurré d'Anjou	12s. 6d.
7	,,	Autumn Bergamot	14s.
21	,,	Beurré Clairgean	10s., 10s. 6d.
55	,,	Chaumontel	9s. 3d.
1	,,	Beurré de Capiaumont	9s. 9d.
1	,,	Glou Morceau	14s.
7	,,	Giblin	—
1	,,	Beurré Diel	6s.
8	,,	Magnifique	10s. 6d.
1	,,	Pitmaston Duchesse	2s.

"In a report on 28th April, 1899, I referred to similar packages being used in sending a small lot of Tasmanian pears, and the splendid condition of the fruit on arrival. The 'trays' were about 5 inches in depth. The perfect condition of Victorian pears sent by the *Omrah* arriving this week, and packed in single layers, indicate that this is the proper way to pack them. If packed in shallow cases, and carried at a temperature of 36 or 38 degrees, I am satisfied all the finest varieties would arrive here in perfect condition, and realize higher prices than can be obtained for the best apples. Grapes packed with bunches in single layers in cork dust, and carried at the temperature indicated, would also arrive in sound condition. It is to be hoped that more attention will be given to the shipment of these two fruits, and if possible, that they will be sent in a separate chamber to the apples so that a lower temperature can be provided for them."

In regard to the arrivals ex *Orestes* and *Oceania*," for apples, prices have been rather disappointing. The unseasonably cold weather experienced for the past fortnight is stated by some engaged in the trade to be unfavorable to the demand and consumption of fruit, and in this way affecting values. Supplies of Tasmanian apples have also been large, the fruit being of a better description than is generally exported from that State. It is not yet equal in quality to that arriving from Victoria or South Australia, but has been realizing within from 1s. to

1s. 6d. per case of prices obtained for fruit from those States, instead of 2s. to 2s. 6d. as in former seasons. The growers in Tasmania are showing more care in grading than in the past.

"Victorian pears, in good condition, realized good prices, especially the finer dessert varieties, such as Winter Nelis, Vicar of Winkfield, Broom Park, and Josephine des Malines.

"Grapes shipped are chiefly of the Doradillo variety. The Waltham Cross, grown in many parts of Victoria, is a larger-berried grape and more attractive in appearance. It is a firm, fleshy fruit, and will carry well. The Gordo Blanco would also carry in good condition. The principal grape exported from Spain to Great Britain is the Almeria, a firm, excellent carrying and keeping variety. This is shipped in small barrels, packed in cork dust, and a leading fruit salesman informed me that he has known the Almeria to keep perfectly sound in this way for three months. It is a variety which might be grown for shipping in Victoria. Another good carrying grape, of which small quantities are occasionally exported from South Australia, is the White Daria. Packed in crates or trays, as referred to in last week's report, and carried at a temperature of from 36 to 40 degrees, there is no reason why large quantities of good table grapes and dessert pears should not be shipped from Victoria each season."

The prices realized for Victorian apples ex *Orestes* and *Oceana* are as follows :—

Munro's Favorite ...	... 10s., 11s., 12s., and 14s.	per case
Annie Elizabeth ...	... 14s.	,,
Cleopatra	... 10s., 12s.	,,
Sturmer Pippin ...	... 9s., 11s. 6d.	,,
London Pippin	... 9s. 6d., 11s. 6d.	,,
Jonathan	... 10s., 11s.	,,
Esopus Spitzenberg ...	... 10s.	,,
Rymer	... 8s. 9d., 9s., 11s.	,,
Rome Beauty	... 9s. 6d.	,,
Reinette de Canada ...	... 8s., 9s. 3d.	,,
Prince Bismarck ...	... 8s.	,,
Scarlet Nonpareil ...	... 9s.	,,
Five Crown	... 9s.	,,
Dumelow's Seedling ...	... 8s. 6d.	,,
PEARS—		
Winter Nelis	... 20s.	,,
Vicar of Winkfield ...	... 18s.	,,
Josephine de Malines ...	... 16s. 6d.	,,
Broom Park	... 16s. 6d.	,,
Napoleon	... 11s.	,,
GRAPES	... 9s to 9s. 3d.	,,

In regard to the varieties of grapes suitable for export to London, it may be remarked that numerous trials of both Waltham Cross and Gordo Blanco have been made in past seasons, with unsatisfactory results. The Gordo Blanco is quite unsuitable since the berries do not adhere to the stalk ; long before arrival in London the cases are filled

with loose berries, mostly in a state of decay. The Doradillo has so far proved the most satisfactory of the sorts usually grown, since the skin is tough, and the berries adhere to the stalk. Though the shipments of this variety on the whole have not proved very profitable, at any rate, they have left a balance—small though it be—on the right side, a statement which would not apply to any of the other varieties experimented with.

Efforts were made several years ago to secure the introduction of the Almeria grape, but, as the importation of all rooted vines or cuttings was prohibited on account of the phylloxera, those in the trade were debarred from improving their position by the cultivation and export of this variety. Latterly, however, some modification of these provisions has been made, and we are informed cuttings have been introduced, under strict supervision, and successfully rooted in this State. Hence, in a few years at the most, we may look for a considerable expansion in the export trade in grapes.

THE CANADIAN APPLE EXPORT TRADE.

By C. H. Hooper,

IN "A YEAR AMONG THE ORCHARDS OF NOVA SCOTIA."

Picking and Packing.

The kind of ladder commonly used for apple picking is one fairly broad at the base, but the sides of which at the upper end terminate in a point; this construction is liked, as the ladder can be so conveniently placed among the branches. The baskets used are of a rounded shape with swing handle, holding a little more than a peck. These are convenient for emptying the fruit gently into the barrels, in which they are removed from the orchard without sorting. Fallen apples are picked up and sent to Halifax.

The barrels of apples are placed either in a special apple-packing house, or more generally in the cellar under the barn or house, ready for sorting and repacking. The apples are sent over to England chiefly between the end of September and the end of March. For sorting, the apples are poured out of the barrels on to a table, usually about 5 feet long and 3 feet wide, with a ledge all round 4 or 5 inches high, covered with carpet, felt, or sacking. The sorting divides the apples into—

1. Of good size and quality;
2. Smaller, but of good quality, both shipped to England;
3. Scrubs, which are sound, but scabbed, ill-formed, or otherwise defective, sent to local market; and
4. Rotten, for pigs.

Sometimes the extra good apples are picked out as specially "selected."

The barrel most commonly used in Nova Scotia is made of fir staves with birch hoops, holding 120 to 140 lbs. fruit, and costing 10d. Barrels with staves of maple or elm, with elm hoops, are used to a lesser extent, but are commonly used in Ontario and the U.S.A.; these hold 140 to 150 lbs. of apples, and cost 1s.

In packing, the bottom and bilge hoops are first nailed, then a thin layer of wood-wool, called "Excelsior," is placed at the bottom, next a sheet of white paper the same size as the end of the barrel. A layer of "headers" is then laid; these are apples of average size, those best coloured being chosen. These are placed stem downwards. The barrel is then filled by carefully emptying in the fruit, using hinge-handled baskets. The barrel is gently shaken each time fruit is added, so as to pack the fruit closely. It is filled 1 or 2 inches above the rim.

In order to get the apples tightly packed, so that they do not move after packing and become "slack" in travelling, a round board lined with sacking or saddlers' felt is placed, padded side downwards, on the top of the apples; the barrel is rocked on the floor, if of cement, or, if

not, on a heavy plank. The apples, thus shaken and pressed, sink to about the level of the rim; any spaces are filled with small apples. Then another piece of white paper is placed on the apples, the chine hoops are knocked up to loosen them, to allow the lid to enter the mouth of the barrel; then the lid is laid on, and the screw or lever-press is applied to the barrel to press the lid into position, followed by the tightening of the chine hoops and the nailing of the head and hoops.

The name of the apple, together with the owner's name and address, are stencilled on the top of the barrel; the name of the salesman on the bottom.

The cost of sending over to England—London or Liverpool—from the Annapolis Valley, *viâ* Halifax, is about—

	s.	*d.*
Rail (60 to 160 miles)	1	8
Steamer (3,000 miles)	2	6
	4	2 per barrel.

The salesman's commission in London is usually 5 per cent.

Mr. S. C. Parker tells me the average net price received by the grower was, per barrel, for the crop of 1896, about 4s. 2d. ($1); for that of 1897, 8s. 4d.; and for 1898, 6s. 3d.

The grower considers 8s. per barrel, clear of expenses (barrel, freight, and commission), a very good price, but occasionally they do not pay expenses, due to inferior fruit, bad packing, or glutted market.

The apples are sometimes bought on the trees at so much a barrel throughout the orchard; and if packed by the grower, 1s. per barrel is paid for picking, packing, and hauling to the station.

There are several large apple buyers who have large stores and packing sheds, capable of holding several thousand barrels. These are generally situated close to a railway station, to enable the barrels to be loaded direct into the cars.

The *London City*, by which I returned, carried 14,050 barrels; the Furness Line, to which this boat belongs, receives a subsidy from the Canadian Government to run a fortnightly service of steamers.

ECONOMIC ENTOMOLOGY.

THE HORSE BOT-FLY.

(Gastrophilus equi, Fabr.)

By C. French.

The present chapter on this pest of the wild or domesticated horse, is compiled from the able article published by the late Miss Ormerod, and sent to me by her, supplemented by personal observations, the illustrations having been drawn by Mr. C. C. Brittlebank from specimens in the museum at my office.

In the case of the "Horse Bot-fly," sometimes also called the "Horse Bee," the method of infestation may be shortly described as follows:—The female fly (Fig. 7) lays her eggs for the most part on the hairs of the mane, shoulders, chin, or on the forelegs, where they can be reached by the tongue of the horse. By this means the eggs, or maggots hatching from them, can be readily licked into the mouth, and thence the maggots pass down into the stomach (Fig. 10). There they fix themselves by their mouth hooks (Figs. 4 and 5), and feed by suction, till after three-quarters of a year, but a much shorter time in Victoria, when they are full grown, they lose hold and pass out of the horse in the usual manner. In the dung, or in the ground, they bury themselves, and turn to a hard dark-coloured chrysalis in which the fly forms, and from which it comes out in summer, after about six or eight weeks. This is the life-history given shortly, but the following details describe the chief points of infestation, of which the knowledge is commonly needed for practical use.

The flies (Figs. 6 and 7) are half-an-inch or somewhat more in length, and clothed with wool or hair. The body between the wings is covered with reddish or olive-brown hair, and some black or dark markings, but the mixture of black, whitish, yellowish, and brown hairs makes it very difficult to describe the colouring clearly, and the descriptions of the different writers vary much. The two wings (Fig. 9) are generally transparent, though sometimes opaque, and white with a smoky or brownish cross-band, the legs being yellowish-brown.

The male (Fig. 6), is rounded at the end of the abdomen, commonly called the tail; the female is more prolonged to a bluntly-pointed shape; but when at rest, this part, which includes the ovipositor, or egg-laying apparatus, is covered under the body.

When the fly is about to lay she hovers for a moment or so near the horse, then, darting down, leaves an egg fixed by a kind of gummy matter (Figs. 1 and 2) to the hair she has selected, and so she goes on until her stock of eggs is exhausted. The eggs are yellowish-white, about the twelfth of an inch in length, spindle-shaped at one end, and attached by the narrow end, the truncate end being free and pendant, and several eggs may be placed on the

one hair, and it is stated that several hundreds may be found on one horse.

The hair of the mane or shoulders, also of the knees and shanks, are parts especially chosen for egg-laying, so that commonly the horse on which they are laid can reach them with its tongue ; but if not, the nibbling or licking of one horse by another, which may often be seen going on in the field, answers every purpose for maggot transportation.

There appears to be some difference of opinion, as expressed by various writers, as to the condition in which the infestation is carried into the mouth. It may be that the egg itself is carried in on the tongue, but one of the more recent views is that the warm moisture of the horse's tongue hatches the eggs, or rather frees the maggots from the eggs if hatching time is near. Another view is that the maggot on hatching crawls on the skin, and thus causes a slight itching, which induces the horse to lick the skin, and thus in either case the maggots may be conveyed into the mouth. Thence, although it is possible some of them may stay by the way, most of them pass downwards or are conveyed downwards with the food into the stomach, where they fix themselves to the white membrane which lines what may be called the "gullet end" of the stomach. In general, "they fix themselves on the gastric mucous membrane, and almost exclusively in the left sac, though some stop in the œsophagus, in the part where the membrane offers the same characters as in the left sac of the stomach."* By the same authority it is noted that the numbers found in one stomach have been counted from ten or more up to hundreds, as 600, 700, or even 1,000, and are stated to be collected in one or more groups, one of which is always larger than the other.

The maggot when first hatched is long, narrow, and somewhat worm-like, but in the stage in which it is best known, up to the second moult, it is of the shape shown in Fig. 3—for the greater part of its length barrel-shaped, banded round with rows of prickles or horny points, blunt at the tail end, widest about the middle, and gradually lessening in size towards the foremost end, in which is a slit or opening that serves the purpose of sucking in food, with a brown hard hook on each side. When full grown the maggots are about three-quarters of an inch in length, and yellowish-drab in colour ; earlier in life they are red or flesh colour.

When the process of fixing themselves has been observed, it is noted that they draw back the mouth hooks until the points are close together, then, keeping them side by side, use them as a boring instrument, until whatever they are working at is well pierced. Next, spreading the hooks sideways and dragging them downwards, the maggots secure such firm hold that no more trouble is needed to keep them in place. When full fed, which in England is about ten months, they loosen their hold, and pass along the intestines, and are discharged by the animal chiefly in the summer season, in Australia from November to April. They then bury themselves in the horse-dung, and in a

* Professor L. Neumann.

space of 24 to 48 hours turn to chrysalids, forming outside of the hardened skin of the maggot, and much resembling it in general appearance ; in colour, after the first 24 or 48 hours, of a light brown changing to dark brown, almost black. From these chrysalids the fly comes out after about four or five to seven weeks in summer.

Prevention and Remedies.

The maggots of *Gastrophilus equi*, as well as those of other species of the *Gastrophili*, are found in horses which frequent pastures or live much in the open air, and do not, as a rule, receive much or regular grooming. The age, state of health, and mode of feeding have no influence on them. Regular methods of treatment are combing, brushing, and clipping away hair from infested parts, and the use of soaps and washes, which would not be in any way injurious to the horse, and would help to get rid of hatching maggots, and in some degree the eggs, though the firm hold of these to the hair makes it very difficult to dislodge them.

Washing or smearings of any kind of insect deterrent, such as kerosene, weak creosote, or other substances, might be used, and would most assuredly help to prevent the egg-laying if applied from time to time to the parts preferred for egg-laying by the flies.

It is stated in the report by Miss Ormerod that in England, at any rate, the flies do not follow horses into stables, so that if this holds good in Australia it might be worth while, as Miss Ormerod suggests, to allow horses access to stables or paddock sheds in hot weather, or when horses showed from the presence of eggs on the hair that much attack was going on. In the case of wild horses they could be enclosed in a crush, carefully examined, and if found to be infested sprayed with kerosene emulsion, which would be likely, if done carefully, to destroy the eggs of the fly. Deterrent means in all cases are the best ; constant care and, when practicable, frequent examination during the time of egg-laying are both necessary and often indispensable.

One very obvious and certain way of lessening recurrence of the infestation is to notice whether there is any indication of the presence of the yellowish or yellowish-pink maggots, or the brown or blackish chrysalids, in the horse droppings, and to take strong measures to destroy them, either by dressings or by treating the droppings so as to render them harmless. If buried, it should be buried to a good depth, since as it is natural to the maggots to bury themselves, in all probability the flies on developing from the chrysalids will, according to their usual habits, simply come up to the surface and take wing, as if nothing had been done.

In regard to remedial measures, this lies in the province of the veterinary surgeon, but in a communication which Miss Ormerod received from Mr. H. Thompson, M.R.C.V.S., of Aspatria, Cumberland, the latter mentioned that he knew of no medicine that would destroy them or make them leave their winter quarters until fully developed, but if it was thought desirable to try some remedy in the way of medicine, he considered 2 oz. of turpentine and 20 oz.

of raw linseed oil, mixed and given as a draught once a fortnight, to be the best.

There are many methods other than those previously alluded to, one being an old bush remedy, which consists of drenching the horse with warm sheep's or other blood, as this, it is held, causes the grubs to loosen their hold to feed upon the blood, when the whole is passed in the usual manner.

Mr. Beswick, of Darnum, Gippsland, has a remedy which he has by personal trials found most effective. It consists of a mixture of one pint of raw linseed oil, one pint of castor oil, one wine-glass full of turpentine. Mix up together, and apply under the jaws and around the breast and shoulders of the horse twice a week. The jaws should first be singed to remove the long hairs to which the fly endeavours to attach its eggs. The effect of the application of this preventive is to smooth down the hair, when the fly is unable to attach its eggs in the place where they are most likely to find their way into the stomach.

A Tasmanian entomologist, the Rev. H. Thompson, gives the following as a good and well-tried remedy:—If it is suspected that a horse is attacked, lose no time, but take ½ oz. of aloes mixed with ½ oz. of shag tobacco, moistened with treacle and made into a ball. Carefully examine the droppings, and if the animal be attacked some of the bots are almost sure to be there. If the horse is attacked, then give 3 oz. of shag tobacco moistened with glycerine or treacle, to which add half-a-teaspoon full of oil of cajeput; make into balls and give all at once. Two hours after give half-a-pint of linseed oil in a pint of gruel. The above dose is for hacks, double for draught horses, one-half for ponies.

Summed up, it would appear that constant vigilance is the price of success in coping with this as with other pests, and as powerful spraying machines may be had in Melbourne it will be seen that some of the obstacles in the way of dealing with unbroken horses have now been removed.

EXPLANATION OF PLATE.

THE HORSE BOT-FLY (*Gastrophilus equi Fabr.*).

Fig. 1.—Eggs as deposited on hair. Natural size.

Fig. 2.—Eggs as deposited on hair. Magnified.

Fig. 3.—Larva of fly. Natural size.

Figs. 4 and 5.—Mouth hooks. Magnified.

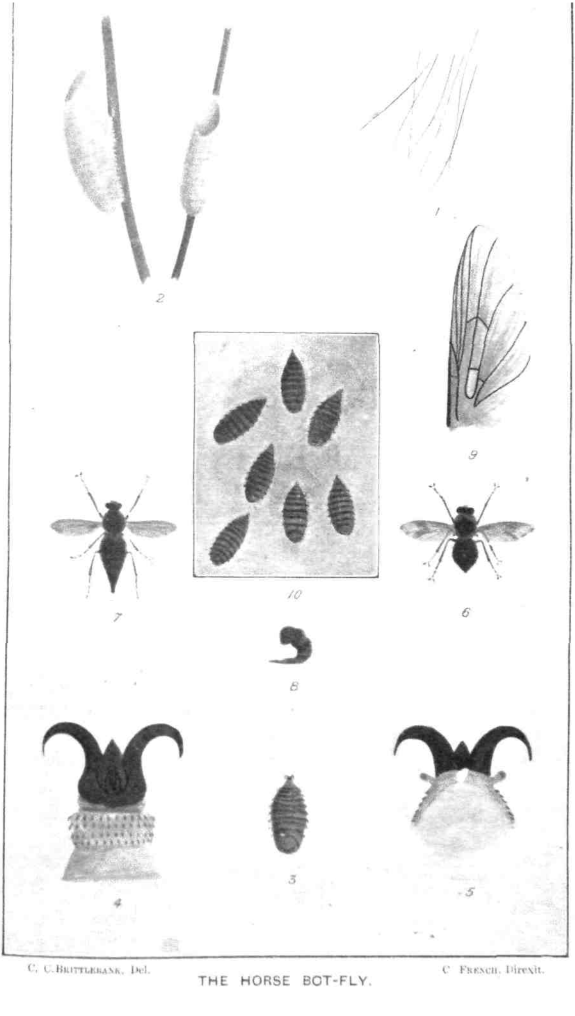
Fig. 6.—Imago or perfect insect, male. Natural size.

Fig. 7.—Imago or perfect insect, female. Natural size.

Fig. 8.—Abdomen of female, side view. Natural size.

Fig. 9.—Wing. Magnified.

Fig. 10.—Portion of stomach showing larvæ of bots attached to same. Slightly reduced.



C. C. BRITTLEBANK, Del. C. FRENCH, Direxit.

THE HORSE BOT-FLY.

LIVE STOCK.

TREATMENT FOR THE BOT-FLY.

By J. R. Weir, Chief Inspector of Stock.

The mortality from the presence of the grubs of the bot-fly in the stomach of the horse is, happily, almost nil in this State. Odd deaths certainly do occur, but when the animals are well-nourished losses are very rare. Those whose business it is to destroy many horses annually, and others who also have special opportunities for observation, are practically unanimous in expressing the opinion that but little harm is done by the bots to well-cared-for horses. It is often noticed after death that animals in which the presence of the grubs are not suspected may have large numbers present, while others again considered as probably affected may prove quite free. The bot-fly has many natural enemies which suffice to keep it in check to a great extent, and, so far at least as the coastal districts are concerned, its numbers have steadily decreased in recent years.

Prevention is, of course, a wise measure, as great annoyance is thereby saved. Any greasy substance may be applied under the jaws and about the neck, shoulders, and legs, and will largely prevent egg-laying. As good a plan as any is to fix a piece of cloth under the neck and behind the jaws. The flies are usually more plentiful near water and about cow-sheds, and stabled horses, as a rule, suffer more than grass-fed, since the former, by rubbing against the feed-boxes, introduce the eggs into their food.

Remedies are numerous; tansy tea is said by some to be an almost infallible method of expelling the grubs. A simple and clean remedy is as follows:—First, prepare the horse for physic by a course of bran mashes, and then after a fast give a drench of one to two quarts of new milk to which half-a-pint of treacle is added. The bots being hungry seize upon the palatable food with avidity, and gorge themselves, and, as a consequence, many let go their hold. After an interval of about two hours a purgative can be given, consisting of raw linseed oil and oil of turpentine. The dose should, of course, be proportional to the size of the horse. An ordinary hack will require about a pint of raw linseed oil and 2 ozs. of oil of turpentine. After this treatment most of the grubs will be expelled, and may be destroyed by burning the droppings, always a safe measure in dealing with intestinal parasites

ANIMAL PARASITES.

By A. A. Brown, M.B., B.S.

No. 6.

Tapeworms or Ribbonworms.

Tapeworm of the Horse.

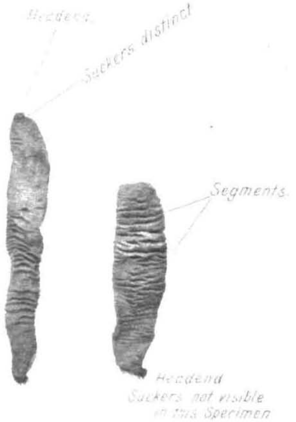
In the horse a short, broad tapeworm, the *Taenia perfoliata*, is occasionally found. It is seldom more than three inches long, and a third of an inch in breadth. The head is rather square, with four prominent suckers. The segments are very short, and, being closely applied, an appearance much resembling the arrangement of the plates, or gills, on the lower side of the head of a mushroom is produced. The hydatid stage of this worm is passed in the bodies of snails or earthworms. To expel this worm, give the horse one pint of raw linseed oil, and keep him away from food for from twelve to eighteen hours, but allowing him access to water. Then give him four drachms of powdered areca nut and 1 oz. of the liquid extract of male fern in a pint of milk. Two hours after the medicine has been given the horse should have a warm bran mash, and should be kept for a couple of days on bran mashes. The day after the administration of the areca nut and male fern, four drachms of powdered Barbadoes aloes should be given, and the tapeworms will come away.

Tapeworm of the Cat.

In the intestines of the cat lives a small tapeworm, the *Taenia crassicollis*. The hydatid stage of this worm is passed in the mouse, a creature upon which the cat preys.

Tapeworms of Fowls.

Many species of tapeworms inhabit the intestines of fowls. The most common forms are the *Taenia proglottina* and *Taenia infundibuliformis*. The hydatid stage of the tapeworms of fowls are passed in the bodies of slugs, earthworms, and snails. It is by eating slugs, snails, &c., that fowls introduce into their bodies the heads of what will form tapeworms. Fowls, as a rule, do not seem to suffer much inconvenience from the presence of tapeworms, and it happens, after a time, that the parasites spontaneously forsake their hosts. Hydatid cysts of enormous size are by no means uncommonly encountered in fowls. As a rule, the cysts are sterile, and it is possible the fowls, by chance, picked up the eggs of tapeworms that had become scattered about along with their food. The fowl, evidently, was not the special host which nature intended the eggs to invade, and, consequently, the process of development came to a premature and fruitless end.



TAENIA PERFOLIATA OF HORSE.

Tapeworms of Man.

Tapeworms in the human subject are not by any means nearly as common as round worms. Tapeworms, however, are to be met with, and, in the Asiatic residents of the State, are evidently frequent sojourners. The tapeworms likely to be met with in the intestines of our people are the *Taenia mediocanellata* and the *Taenia solium*.

The *Taenia mediocanellata* may attain a length of 20 to 30 feet. Its hydatid stage is passed in the muscles, or flesh, and organs of the ox. When the bladder worm, or hydatid, is found in the muscles or flesh, such flesh is called "measly" from its appearance. "Measly" beef is unknown in Victoria. It is by eating "measly" beef in the raw or improperly cooked state, or eating organs containing hydatid cysts, or by eating flesh contaminated with the contents from ruptured hydatid cysts, that man becomes infested with this tapeworm. To prevent risk of infection, meat should be properly cooked. When meat is thoroughly cooked, no danger from the introduction of the "heads" or "scolices" of the worm is then to be apprehended. Oxen are likely to pick up the eggs of the worm on fields where waste human matters have been scattered. They should not be allowed to browse over such fields, nor to drink out of pools where the waters have been contaminated by their drainage.

The *Taenia solium*, in its hydatid stage, is found in the organs and flesh of pigs. Pork, in which the little cysts are found, is called "measly" pork. "Measly" pork is unknown in Australia, though common enough in Europe and America. "Measly" pork would be a dangerous commodity to handle, because a scolex or head might get introduced into the mouth from contaminated hands, or from the knife which had been used in the dressing or cutting up of the carcass. Butchers have a habit of holding their knives in their mouths, and, if they have cut through a hydatid cyst, which is often encountered in the organs of pigs, they may thus, by such practice, introduce into their systems larvæ of the tapeworm.

This tapeworm is most difficult to expel, and is a most formidable inmate of the intestines. To prevent this worm invading man, pigs should not be allowed to gain access to waste human material. They must not be allowed to drink water that has flowed over lands that have been treated with night-soil, nor to roam over such lands. An egg from this tapeworm may even be swallowed by man himself instead of by the pig, in whose body it usually develops to the hydatid stage. When swallowed by man, the embryo is set free in his stomach, and it then bores its way into the blood vessels, and is thence carried to some distant organ, where it becomes an hydatid cyst.

Hydatids in Man.

Hydatids in man, in many cases, may have originated from eggs of tapeworms, not destined by nature to reside in his tissues, becoming lost in their way to gain the bodies of their proper hosts. By some accident the eggs have been swallowed by man, and they then find their way from his stomach into various other parts of his body, and

there they develop into hydatid cysts. Hydatids are introduced into the human system by means of food and drink. None other but pure water should be consumed. It should not be contaminated with sewage of any kind, and under no circumstances should waters intended for human consumption be polluted with droppings of animals. Water from doubtful sources should be filtered before use, and when this is impracticable it should be boiled. Another method of purifying water is the soda-alum method. Twelve grains of alum in solution are added to a gallon of water, the solution being gently stirred in so as not to provoke any air bubbles in the water. A quarter of an hour later 9 grains of soda in solution are then stirred in, adopting precautions to prevent formation of air bubbles as before. In a few hours it will be found that a copious sediment has been formed, and that all the impurities in the water have been carried down with it, leaving the clear and limpid water at the top. The sediment will include the bacteria and other forms of life, and the clear fluid should be carefully siphoned off before use. With an appropriate number of vessels of sufficient capacity, any volume of water can be purified by the process, providing that the proportions of alum and soda indicated are employed. In order, also, to prevent the introduction of hydatids, no raw vegetables should be consumed unless subjected to repeated washings with water from wholesome sources, and beef and pork should not only be free from measles but should not have been soiled by the contents from ruptured hydatid cysts. The proper cooking of meat minimises the danger of invasion.

In the treatment of tapeworm, certain steps have to be adopted before the drugs, which are potent enough to expel the parasites, are administered. The drug should be given after a fast, and with the intestines previously cleared by a dose of castor oil. After the evening meal, which should consist of a little boiled milk, the castor oil in full dosage is given, and the next morning the worm expeller, the liquid extract of male fern, is given. A couple of hours later another dose of castor oil is administered. After the male fern has been given, a breakfast of warm milk can be partaken of. To a child of ten, 40 drops of the liquid extract of male fern is given as an emulsion, with 30 grains of the compound tragacanth powder in a little milk. He should remain in bed after taking the medicine, as the recumbent position prevents the vomiting which often occurs.

VEGETABLE PATHOLOGY.

DISEASES OF PLANTS AND THEIR REMEDIES.

By D. McAlpine.

IV. Brown Rot or Ripe Rot of Fruit.

(*Monilia fructigena.*)

This disease is most noticeable in the fruits, as it causes them to rot, but the twigs are also affected and destroyed by it, causing what is known as twig blight. Not only does it occur on the young shoots, but the leaves and even the flowers are attacked by it. Stone fruits generally are subject to this disease, and it has been found here in peaches, plums, apricots, and cherries, while the apple is specially liable to it.

SYMPTOMS.

The rotting of the fruit is the most striking symptom, with the ash-coloured spores produced on the surface. At first brown scattered patches appear on the skin, then the small tufts of spores are seen, and finally these tufts are arranged in irregular circles, which blend to form a continuous mass. The rotted fruit generally dries up, and forms the shrivelled "mummy" peaches often seen hanging tc the dead branches.

On the leaves, where the fungus is generally overlooked by the grower, it forms velvety, olive-brown, thin patches, consisting of the spores which originate from the fungus filaments inside the leaf. The ripe spores are washed away by the rain, or carried by the wind, insects, or birds to the young leaves or growing fruit, there to start the disease afresh if the conditions are favorable.

EFFECTS.

The blighting of the twigs in the early spring is most serious in its effects, often causing the blossom to wither, and consequently an absence of fruit. In the fruit it disorganizes the tissues, and its entire destruction by rotting takes place. It is said to be one of the worst fungus diseases of the peach over large portions of the United States.

NATURE OF FUNGUS CAUSING DISEASE.

The rotting of the fruit is generally attributed to the weather, but a fungus will be found associated with it. Fungi are favored in their growth by warm weather, and if this is accompanied by moisture, particularly near the time of ripening, then the rot will spread with rapidity, and the fruit suffer accordingly. The fungus causes the rot, and the weather is simply a condition acting favorably or unfavorably towards its development.

The germinating spores may enter the twigs through the blossoms, and the slightest puncture of the fruit by insects or other agency will induce that entrance. Once inside, the filaments of the fungus branch and spread in a luxuriant manner, soon killing the tissues, and causing them to turn brown. Then the spores are produced at the surface in such countless numbers that they give the part attacked an ashy-grey appearance, and distributed by various agencies the disease is often spread in the form of an epidemic. The fungus filaments are present in a resting state in the fallen or mummified fruits, and probably also in the blighted twigs, so that by this means the fungus tides over the winter.

Treatment.

It is evident that all diseased fruit should be burnt in order to prevent the disease spreading. Not only should the fallen fruit be gathered and burnt, but the rotten fruits should be removed as they appear on the tree. The diseased branches should also be destroyed in order to reduce the sources of infection. Spraying with Bordeaux Mixture is also recommended just when the blossoms open and again when the fruit has set, in order to destroy the germinating spores.

PLATE II:

Fig. 1. Peach with large brownish-grey patches caused by rust (*Puccinia pruni*).

Fig. 2. Peach destroyed by "Ripe Rot" (*Monilia fructigena*).

Fig. 3. Peach with large black patches caused by *Clasterosporium carpophilum*.

Plate II

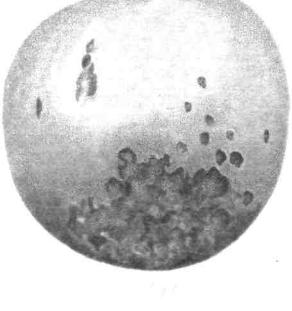


Fig. 1

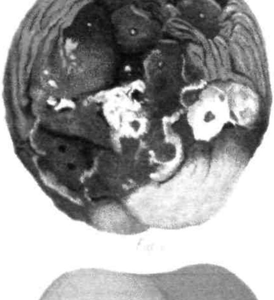
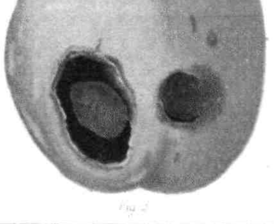


Fig. 2



C. C. Brittlebank Del. Fig. 3 D. McAlpine Direxit

THE FUNGUS CAUSING "BLACK SPOT" OF THE APPLE AND PEAR.

(*Fusicladium.*)

By D. McAlpine.

There is no need now in Victoria, as was the case a few years ago, to discuss at length the fungus-origin of the Black Spot, or the question whether it can be controlled by spraying. So it will only be necessary in this paper to explain to the orchardist the nature and life-history of that organism which is only too well-known from its effects, though requiring the microscope to reveal its true character. And let it not be thought that such minute details have no bearing on the practical work of eradication, for it is only this knowledge which gives certainty to our operations. Although there are still gaps in our information, sufficient is known at present to enable us to treat the parasite at the right time and in such a way that it is either rendered harmless or destroyed.

First Appearance in Australia.

This disease was first recognised in Europe on the fruit as early as 1819, and described on the leaf in 1833. According to Berkeley, it was first noticed in England in 1845, but, from the accounts recently given of it, it does not seem to do much mischief there. It has made its appearance in all the Australian States, and seems to thrive well, except where the climate is neither too hot nor too dry. It seems to have been first observed in Victoria, a nurseryman in the neighbourhood of Melbourne dating its appearance as far back as 1862. In South Australia, according to the late Frazer S. Crawford's "Report on the Fusicladiums," it has been certainly known as early as 1877, the introduction of the disease being attributed to a Seckel pear imported from America. Once having found its way into Australia, either through America or Europe, it was simply a matter of time to spread wherever the climate was favorable to its development.

Varieties most and least Affected.

Their greater or less susceptibility to the disease is a marked characteristic of several varieties, but while some spot badly and others only slightly, there are no grounds for believing that any variety is absolutely scab-proof. However there are some which are so comparatively free in a season favorable to the disease, that the orchardist regards them as practically clean. There is no attempt here to give a complete list of clean and unclean varieties, but simply to record those under their appropriate headings which are in general cultivation. It is astonishing how generally Bitter Pit is confounded with Black Spot, and therefore it is necessary to repeat that the disease caused by *Fusicladium* is only taken into account here.

I have not given the same attention to the pear as to the apple in connexion with Black Spot; but there are some growers who affirm that pears generally are susceptible, but some more so than others. Among the worst may be mentioned Beurré Bosc, and Williams' Bon Chrêtien. It is noticeable among the pears that while the leaf is generally little affected, the fruit is more particularly so.

MOST AFFECTED.

Apples.		*Pears.*
Ben Davis.	Ribston Pippin.	Williams' Bon Chrêtien.
Cleopatra.	Scarlet Nonpareil.	Beurré Bosc.
Dumelow's Seedling.	Shepherd's Perfection.	Beurré de Capiaumont.
Gravenstein.	Stone Pippin.	Citron des Carmes.
Irish Peach.	Sturmer Pippin.	Vicar of Winkfield.
Munro's Favorite.	Yates.	Pitmaston Duchess.
Newtown Pippin.	Rokewood.	Bailey's Bergamot.
Pomme de Neige.		

LEAST AFFECTED.

Apples.		*Pears.*
Cox's Orange Pippin.	Pioneer.	Broom Park.
Duchess d'Oldenburg.	Reinette de Canada.	Gansell's Bergamot.
Five Crown.	Rome Beauty.	Keiffer's Hybrid.
Hoover.	Rymer.	Josephine de Malines.
Jonathan.	Statesman.	Howell.

Symptoms.

Although the effect upon the fruit is the most noticeable feature of the disease to the orchardist, yet, as a rule, the fungus first appears on the leaves, and may attack the young shoots as well. Small round dark-green spots appear usually on the upper surface of the leaves, and these gradually increase in size, and run together, until large, irregular, sometimes raised, dark-coloured blotches are formed. It may also occur on the lower surface of the leaf, and the leaf stalks as well. The result often is that the leaf is completely destroyed by the parasite, and the tree is deprived of the necessary nourishment obtained by means of the leaves.

On the fruit, "scabby" patches are produced, and these may so run together that the entire surface is more or less covered, although it is usually one-sided in its character. The very thick cuticle developed may then begin to crack, and the fruit, in bad cases, is fissured, distorted, and altogether unsightly and unpalatable from this cause. The name of Black Spot generally given to the disease in Victoria is founded upon the spotted appearance of the fruit, particularly in the early stages, while Scab is the common name in America, and Cracking in Britain, from the way in which the fruit is fissured by the fungus. The name of Apple Rust, or Scurf, is also given to it in Germany. It will be observed that the popular names are based upon the appearance presented by the fruit, for its existence upon other parts is quietly overlooked or ignored. The fungus also occurs occasionally on the young twigs, where it causes a blackening.

Effects.

When occurring on the leaves, the fungus not only invades and destroys the tissues, but it uses up that nourishment which should go to the building-up of the tree. Under these circumstances, the leaf is no longer able to fulfil properly its nutritive functions, and in bad cases a premature shedding of the leaves takes place. The consequence is that the general health of the tree suffers, and its fruitfulness is interfered with, and all the evils consequent on starvation arise. It is on the fruit, however, that the most marked effects are produced, and it is from this point of view that the grower judges of the damage done. As we have seen, the fruit may not be worth picking, small in quantity, and poor in quality. The miserable-looking specimens are much smaller than the normal, very one-sided in their development, cracked and scarred where the spots have been, deficient in flavour and in keeping quality, and altogether unsightly when badly diseased, and unfit for the table.

It is said that it is the side of the fruit most exposed to the light which is worst affected, but at any rate there is generally one side most scabbed and consequently unequally developed. The fungus there absorbs the nourishment which should go towards the regular swelling of the fruit, and so the one side grows at the normal rate, while the other stands still, as it were, and becomes, at the same time, deformed. The fruit-buds for next year are likely to be stunted in their growth, and thus the final result must be to weaken and shorten the life of the tree.

Losses from Black Spot.

It is a matter of great difficulty to accurately estimate the losses incurred annually through the attacks of the Black Spot fungus. In the first place, the extent of the damage varies according to the varieties, some being practically immune, and others, again, very susceptible. Further, only in the moister districts, mostly south of the Dividing Range, can this fungus, as yet, find the requisite conditions for its development. Mr. Grant, of Pakenham, a typically moist district, estimates that on the 130-acre orchard there the average annual loss has been £1,500, but since the success obtained by spraying this has been entirely obviated. Each tree left unsprayed for comparative purposes last season, represented, on an average, a loss of £1 among the liable kinds. Similarly, at Somerville, Mr. A. Warren furnishes figures which worked out on the basis of total loss per acre of all apples, liable or not, grown by him, amounts to £10 per acre, which closely agrees with Mr. Grant's estimate. Assuming that the average annual loss is only one-half as great per acre on the total area of apples south of the Divide rather more than 8,000 acres, then £40,000 may be taken as roughly representative of the annual losses in Victoria in apples alone. Other growers have supplied figures which suggest that the above estimate is rather beneath the mark than an exaggeration.

Mr. H. M. Nicholls, writing in the June number of the *Agricultural Gazette of Tasmania*, states that this disease "does more damage and occasions more loss than all of the other pests combined." From this it may be judged that the losses in the island State are at least as great per acre as in Victoria, and the total for the Commonwealth must be enormous.

Conditions favouring the Disease.

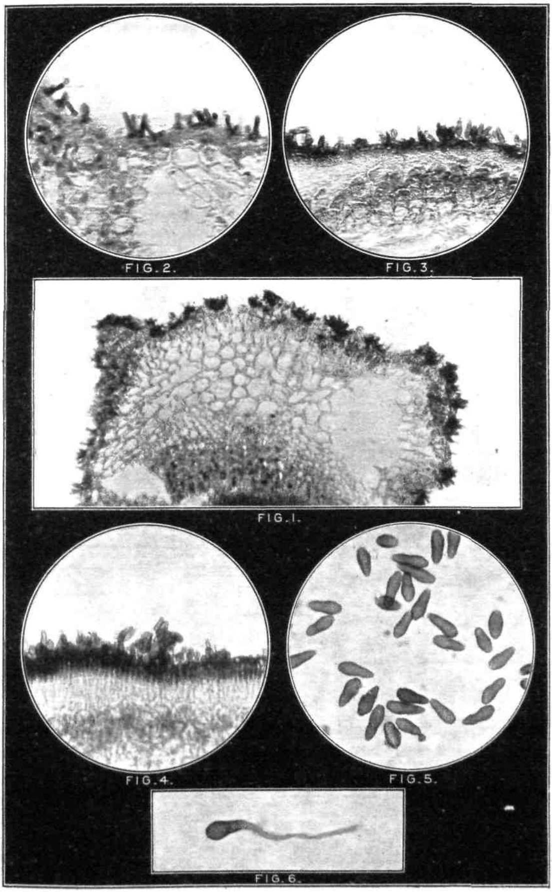
The past season was particularly favorable to the disease, both on the apple and pear, and since it is much worse some seasons than others, a reason for this is naturally sought. Seeing that the disease is caused by a fungus, it is thereby more or less dependent on weather conditions, which influence its development.

Since the spore, like a seed, begins to germinate in the spring, wet weather favours the germination, and, at the same time, renders the tissue of the host plant succulent and susceptible. If this wet spring is followed by a cool summer, or by alternating extremes of wet and dry weather, then the fungus, having already had a good start, is enabled to reproduce itself freely. With very showery weather at the time of blossoming, as was the case in 1901, the most favorable conditions were present for the fruit being successfully attacked. On the other hand, if the spring is dry and the summer hot, then comparatively few of the spores will be able either to germinate or to penetrate the tissues, and this, coupled with succeeding hot weather, will prevent any serious infection by the fungus.

The northern districts of the State are practically free from this disease, and a succession of dry springs has, no doubt, helped to this end, but it remains to be seen whether this immunity will continue through a succession of wet springs. Trees in all stages of growth are attacked—the young stock in the nursery, as well as the older fruit-bearing trees, and the fruit, too, may become infected from its earliest appearance up till the ripening period, for recently fruit has been met with attacked when fully grown.

Nature of Fungus.

If a section is made through a diseased leaf, the fungus threads are seen spreading beneath the surface and bearing innumerable short branches (Figs. 1, 2), which ultimately rupture the epidermis, or skin. Each of these branches bears a single reproductive body at its tip, called a spore, and it is by means of these spores (Figs. 3, 4, 5), produced in unlimited quantity in a favorable season, that the disease is spread. It will be seen from this brief description that the parasitic fungus causing this disease is a lowly form of plant, having its *roots* which, instead of entering the soil, penetrate the tissues of the leaf or the fruit, and absorb its nourishment from them, while the very short and upright *shoots* bear the reproductive bodies. The spores, as shown in Fig. 5, are somewhat egg-shaped, or slipper-shaped, of an olive colour when mature, and, although at first continuous, they may



G. H. Robinson, Photo.

THE BLACK SPOT FUNGUS.

sometimes develop a transverse partition, or septum. They vary considerably in size, and it takes from one to two thousand to cover an inch lengthwise, or three to four thousand side by side. The scientific name of the plant on the apple is *Fusicladium dendriticum*, whereby it is distinguished from other fungus-forms which produce "Black Spot" of the vine, &c. The second name is given to it from the dendritic, or tree-like, manner in which it grows upon the leaves, branching from the centre all round. That on the pear is known as *F. pyrinum*, but some regard it as identical with the form on the apple.

Life History of the Fungus.

Starting with one of the spores, it begins to germinate by putting forth a slender delicate tube (Fig. 6), and if this is in contact with a young and tender leaf, or a young fruit just forming, it penetrates the interior, and lives at the expense of its host. The germ-tube, having effected an entrance, soon branches beneath the skin or epidermis, and forms a compact mass of fungus-filaments, or mycelium, which by its growth soon splits the skin. Since this growth takes place with nearly equal rapidity all round, it preserves a somewhat circular outline. Fresh spores placed in water begin to germinate within twelve hours, and in twenty-four hours the germ-tubes may be several times the length of the spores. These are most frequently produced from the apical, or pointed end of the spore, but sometimes they emerge from the other end. This process of germination and infection may be repeated by innumerable spores throughout the growing season, but the question now arises—how does the fungus tide over the winter and reappear in the following spring?

This is a most important question to settle, although it is by no means easy of solution, and one which growers are constantly asking information about. It was at one time considered that the fungus survived by means of the fine threads, or mycelium, existing in the fallen fruit, and when the spring came round a crop of spores were produced which were easily carried to adjoining trees, and there began to germinate, if sufficient moisture were present. Some investigators have maintained that it remains dormant on the young twigs, and in the spring spores were produced as above described.

To me it appears more than probable that, so far as we in Victoria are concerned, the only sources of infection worth taking into account are the spores produced by the fungus on the leaves or fruit in one season, which may become entangled in the hairs or scales of the buds. In the succeeding spring these are likely to find conditions favorable for their development, and serve to reproduce the disease.

It is not uncommon for parasitic fungi to produce two kinds of spores—one the summer spores and the other winter spores, the latter being protected against injurious influences such as excessive cold, moisture, &c., and thereby enabled to survive the winter and infect the host next year. As regards the Black Spot, the one form is developed on the living plant and the other on dead and fallen leaves. It is not necessary here to enter into details about the latter fungus

further than to say that the spores are enclosed in bags, and these bags, in turn, are protected by a case. In the spring, spores of this fungus are said to be capable of producing the *Fusicladium* stage of Black Spot, and so the life-cycle is completed, starting from the naked spore in the one spring and ending with the covered spore in the succeeding spring. So different did this stage of the fungus seem from that of the commonly recognised Black Spot that the distinct name had been given to it of *Venturia inaequalis*. These two stages of the same fungus have been found in both Europe and America, but no trace of the latter as yet in Australia. Mr. G. P. Clinton, of the Illinois University Agricultural Experiment Station, has carefully investigated this fungus through three successive years, and he makes the statement, in Bulletin No. 67, that "Neither was there found any evidence that the old spores lived over the winter on the fallen leaves, or that the mycelium in these gave rise to a new crop for spring infection.' Fallen leaves from badly spotted trees are at present being kept for further investigation by myself, but it seems most probable that, as in the case of rust-in-wheat spores, the summer stage is able to survive the winter here, and start to germinate afresh in the return of spring.

EXPLANATION OF PLATE.

(*Fusicladium dendriticum.*)

Fig. 1. Section through the mid-rib of an apple leaf, showing the dark clusters of spore-bearers, or conidiophores, of the fungus arranged round the margin ... ... ×100

Fig. 2. Part of the same section more highly magnified, and showing clearly the appearance of the individual spore-bearers ... ... ×200

Fig. 3. Section through a young spot on an apple fruit, showing the production of spores on the surface ... ... ×200

Fig. 4. Section through a well-developed spot on an apple fruit, showing the dense mass of spore-bearers, which is colourless at the base, but quite black at the top, with a few spores still attached ... . ×200

Fig. 5. Group of spores from a spot on an apple leaf ... ×400

Fig. 6. Germinating spore from an apple leaf kept in a moist chamber ... ... ×400

SPRAYING FOR FUNGUS DISEASES.

By D. McAlpine.

Nearly all the preparations so far successfully employed to control the attacks of the fungus enemies of cultivated plants are forms of copper compounds. Sulphate of copper, or bluestone, is generally regarded as the cheapest and most reliable basis for the manufacture of these sprays. Though a simple solution of bluestone has been used for very many years, and is still the favorite preventive for the stinking smut of wheat, yet it was not until 1882 that any great headway was made in treating plant diseases. In that year Millardet, at Bordeaux, in France, found that a compound of bluestone and lime which had been applied to some vines to prevent the fruit being eaten, had a most remarkable effect in checking the dreaded mildew.

This compound, now regarded as the best all-round fungicide, received the name of Bordeaux mixture from its place of origin. Since then various preparations have been brought forward for similar purposes, and of these there may be mentioned the Ammoniacal Copper Carbonate, the Copper-Soda or Burgundy Mixture, and Copper Acetate. Each has special features of value, but none have so far proved as satisfactory for general work as the Bordeaux. For this reason discussion here will be restricted to the methods of manufacture and employment of the three most useful sprays at present known, viz., the Bordeaux and Copper-Soda mixtures, and the simple solution of Copper Sulphate.

BORDEAUX MIXTURE.

As has been said, the mixture is a compound of bluestone and lime. There are no strictly-defined proportions in which these constituents should be mixed, though it is known that the lower the proportion of lime present, provided the mixture is not acid, the more satisfactory are the results. This is clearly shown in experiments at Pakenham last year, when the 6.4.50 formula gave 57 per cent. of absolutely clean fruit, the 6.8.50 only 18 per cent., and the 6.12.50, barely 12 per cent. As was noted in a previous article dealing with these experiments, the first figure in the formula represents the quantity of bluestone in lbs., the second the lime in lbs., and the third the water in gallons.

It is sometimes stated that no injury to the opening leaves or flower buds will result from a large excess of lime. This is quite contrary to the results in last year's experiments. At Pakenham, it was found that a 6.4.50 Bordeaux caused no injury to the young buds, but considerable harm occurred with a 6.8.50 formula, while the 6.12.50 was quite as severe as a plain solution of bluestone. When it is desired to keep down the proportion of lime to the lowest possible point consistent with safety, then the use of the Ferrocyanide test will enable this to be done. Dissolve 4 oz. of ferrocyanide of potassium in one pint of water, and add a few drops of this to a small quantity of the mixture to be tested, placed in a glass vessel for preference.

Should any brownish discolouration occur, then the mixture does not contain enough lime; hence, lime milk must be added till, on testing, no discolouration is apparent.

The 6.4.50 formula is recommended as the best and cheapest for general use, though in wet districts the quantity of water may be reduced to 40 gallons. At the same time it is well to state that more profitable results and higher percentages of absolutely clean fruit are expected not from more concentrated mixtures, but from the addition of small amounts of certain substances likely to increase the adhesiveness and spreading power as well as poisonous action of the more dilute formulas. The substances which have given good results so far are Sal-Ammoniac, Saltpetre and Salt, any of which may be added to the lime milk at the rate of 1 lb. to every 50 gallons of Bordeaux. Other substances worthy of trial on a small scale are Nitrate of Soda, Silicate of Soda, Sulphate of Ammonia, Sulphate of Lime (Gypsum), Sulphate of Potash, and Sulphide of Soda. When either Sulphate of Ammonia or Sal-Ammoniac is added to lime, ammonia is given off slowly, so these additions should only be made just before using the spray. Attempts will be made to ascertain whether these or any other of the substances named would prove more useful if added, in solution, to the finished Bordeaux.

How to prepare Bordeaux.

For the proper preparation of this mixture three or more barrels are essential, and two of these should have a distinct mark on the inside to indicate when they contain 25 gallons, as much valuable time will then be saved and strict accuracy insured. Though bluestone is easily soluble in cold water if suspended just below the surface, the process is much more rapid if the water be first heated. Take 6 lbs. of bluestone and place it in a small sack, such as those in which sugar is generally sold. A kerosene tin of hot water should then be poured into one of the marked barrels, and the bag of bluestone either suspended just below the surface of the water as shown in Fig. 1, or it may be held by the top and agitated until complete solution is secured. When this has occurred, make up to 25 gallons with cold water. Then take 4 lbs. of good fresh quick-lime in hard lumps and slake it in the other marked barrel, adding only a very little water at first, about a pint is sufficient. When this has been absorbed add a little more, and so on from time to time, till all the lime has crumbled down, care being taken not to let it get too dry. In this way a good lime will furnish a smooth thick paste practically free from lumps. Make up to 25 gallons by adding cold water, and stir thoroughly. When both milk of lime and bluestone solution are quite cool, they should be poured *evenly* together into the third barrel, capable of holding 50 gallons. To

Fig. 1.—How to Dissolve Bluestone.

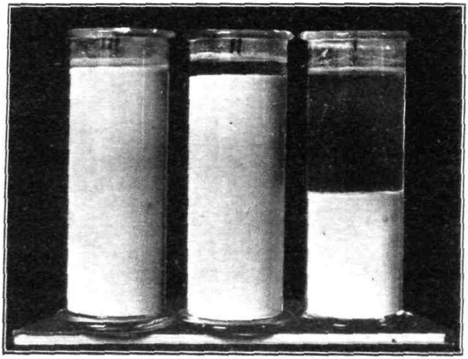
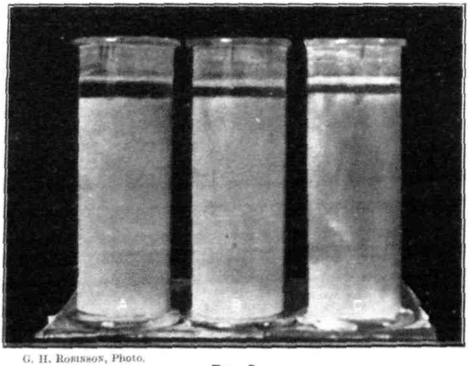


FIG. I.

(A) Dilute Lime and dilute Bluestone poured *evenly* into third vessel
(B) Dilute Lime poured into dilute Bluestone.
(C) Strong Lime poured into strong Bluestone.

AFTER STANDING ONE HOUR.



G. H. ROBINSON, Photo.

FIG. 2.

(A) Dilute Bluestone to dilute Lime.
(B) Dilute Lime to dilute Bluestone.
(C) Dilute Lime and dilute Bluestone poured *unevenly* into third vessel.

AFTER STANDING ONE HOUR.

secure even mixing, which is of considerable importance, the barrels for the bluestone and the lime should be mounted on a raised platform and furnished with wooden taps, and the liquids may then be run in V-shaped troughs, into the third barrel arranged underneath. (Fig. 2.) On the top of the latter should be placed a large wire strainer on a movable frame to prevent the entrance of grit, and, lastly, a thorough stirring should be given to the mixture for a couple of minutes.

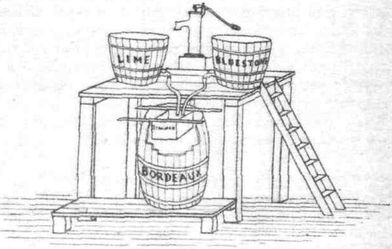


Fig. 2.—Mixing Plant.

When large areas have to be sprayed it will be found most convenient to erect the platform at the edge of a dam, or in any situation where water can be obtained from a pump or tap, and a small force pump fitted to the mixing barrel will prove very useful for lifting the Bordeaux into the spraying machine.

Properly and Improperly Prepared Mixtures.

The method of preparation just described gives the best results, and whenever spraying has to be done on a commercial basis the cost of providing some such plant as shown in the figure will be amply repaid the first season. As will be seen on reference to Plate 1, Fig. 1a, when the dilute lime milk and the dilute bluestone solution are poured evenly together into a third vessel, the bulky gelatinous precipitate of a soft blue colour that forms remains for a long time in suspension, only a very slight tendency to subsidence being noticeable after standing perfectly still for one hour, there being, in a 10-in. cylinder, not more than a quarter of an inch of clear *colourless* liquid at the top. The results of attempting the manufacture of Bordeaux mixture in other ways is shown in the accompanying plates, where it will be noted that the process above described, and which we may call the standard method of preparation, gives considerably the best results.

Under no circumstances should strong milk of lime be added to a strong bluestone solution, or *vice versâ*, or poured together evenly into a third vessel, as the precipitate then begins to subside immediately, *both must be diluted* previous to mixing. In mixing strong milk of lime and a concentrated bluestone solution in cylinders 10 inches high, a settlement of more than 1 inch occurred within ten minutes, and over 4 inches in half-an-hour, while it is probable that the resulting compounds are somewhat different to those obtained when dilution is made before mixing. Even if such mixtures were as efficacious in the treatment of disease, which is not the case, there would still remain the difficulty of maintaining an even strength in spraying.

A Special Warning.

Poor or air-slaked lime should never be used, as no amount of the latter with bluestone solution will produce a Bordeaux mixture. It is certain that much non-success in spraying is due to the use of air-slaked lime, which is largely chalk. When a milk made from this is mixed with a bluestone solution, a precipitate almost entirely chalk, rapidly settles to the bottom, leaving a clear *blue* solution of Copper-sulphate, occupying about nine-tenths of the vessel (Plate II. Fig. 3). When good fresh lime is not easily obtainable it will be found more satisfactory to use the Copper-Soda Mixture instead.

Stock Solutions.

There are doubtless some who, to simplify the process of manufacture, would prefer to use stock solutions. A convenient method is to dissolve 100 lbs. of bluestone in a 50-gallon cask; after filling the barrel with water every gallon would hold 2 lbs. of bluestone. Similarly 100 lbs. of lime could be slaked in another cask and made into a paste, perhaps reaching to a mark corresponding to 25 gallons. Then to make up the 6.4.50 formula, take 3 gallons of stock bluestone and put into one barrel, making up to 25 gallons with cold water, and 1 gallon of lime paste, after thorough stirring, should be placed in the second barrel and diluted to 25 gallons. The after procedure would be the same as previously described. If lime paste is to be kept for a few days, then it should be covered with about 6 inches of water.

THE COPPER-SODA SPRAY.

This spray is of recent origin, and in it washing soda takes the place of the lime in the Bordeaux. Though the results obtained from its use in our experiments were hardly as good as with Bordeaux, this probably arises from the use of too small a proportion of soda. Only 6 lbs. was used to every 6 lbs. of bluestone, while other investigators have recommended 8 or 9 lbs. There seems no reason why this mixture should not prove quite as efficient as Bordeaux, and exhaustive experiments will be conducted to determine whether any addition can be made to increase its effectiveness.

The formula recommended for general use is the 6.9.50, that is 6 lbs. of bluestone, 9 lbs. of washing soda, and 50 gallons of water. The process of manufacture is exactly the same as in Bordeaux, the bluestone should be dissolved in one barrel and made up to 25 gallons, and the washing soda dissolved in the other and also made up to 25 gallons, the two solutions then being run evenly into a third barrel. Here there is no necessity for a strainer, as the washing soda dissolves completely. The resulting mixture is of a sky-blue colour, but more watery in appearance than Bordeaux. It possesses one advantage in that the hands are not appreciably corroded by it, but as against this scarcely any perceptible deposit is seen on the trees after the spray has dried. Hence some substance might be added, so that its presence may be more easily detected, and the quality of the work done by the sprayers more readily determined. To those with a desire to experiment in the improvement

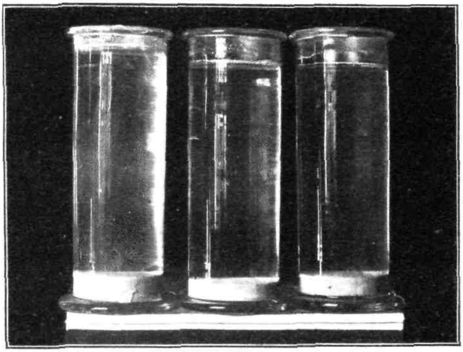
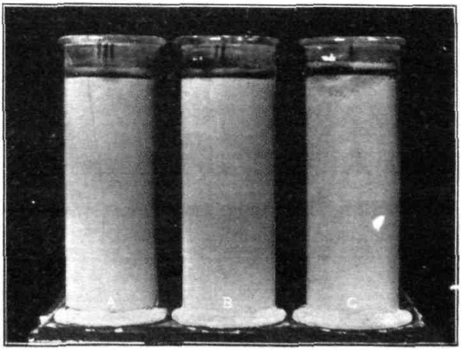


FIG. 3.

AIR SLAKED LIME WILL NOT MAKE BORDEAUX MIXTURE.

(Same process of making as in Plate I., Fig. 1.)

AFTER STANDING TWENTY MINUTES.



G. H. ROBINSON, Photo.

FIG. 4.

(A) Bordeaux + Saltpetre.
(B) Bordeaux + Sal-Ammoniac.
(C) Bordeaux + Salt.

AFTER STANDING ONE HOUR.

of this mixture it may be suggested that any of the following substances may be added to the soda solution before mixing with the bluestone, viz. :—Sal Ammoniac, Gypsum (Sulphate of Lime), Soft Soap, Molasses, Saltpetre, Sulphate of Ammonia, Nitrate of Soda or Salt. Generally speaking about 1 lb. of any of the salts may be used, though 2 lbs. of Gypsum might be more satisfactory, and the latter quantity when using Soft Soap or Molasses. Perhaps it is hardly necessary to add that such experiments should be conducted on a small scale only, say on single trees, the bulk of the spraying being done with the ordinary Copper-Soda.

BLUESTONE AND SOFT SOAP.

A simple solution of Bluestone, 2 lbs. in 50 gallons of water, with 4 lbs. of Soft Soap in addition, is a cheap and valuable fungicide for use in comparatively dry districts. Owing, however, to its strongly acid nature, it is liable to cause considerable scorching of the leaves if applied after the buds burst, hence it is advised for use only before the blossoming.

WHEN TO SPRAY.

When Bordeaux mixture was originally introduced, much stress was laid upon the necessity for winter spraying. Considerable misapprehension seems to have arisen from the use of this term, as many growers have done the work in midwinter and afterwards found no great benefit. It may be taken for granted that every one wishes to get the best possible results from one spraying alone, there being no desire to repeat the operation if it can be avoided. It will be found more satisfactory not to commence till the buds are on the point of bursting. Trees which bloom before any appearance of green can, with safety, be treated up to the time when the first few flowers have expanded, and the rule is that the nearer the spraying to the opening of the flowers the more efficacious will it prove. In other trees such as apples, where the flowers are borne in clusters encased in leaf-like organs, it is best to wait till these latter are partially open. No appreciable damage will occur even from spraying when apples are in full bloom if properly prepared Bordeaux mixture is employed. In the case of Copper-Soda, such late spraying should be done cautiously, and not less than 9 lbs. of washing soda used to every 6 lbs. of bluestone in the 50 gallons of water.

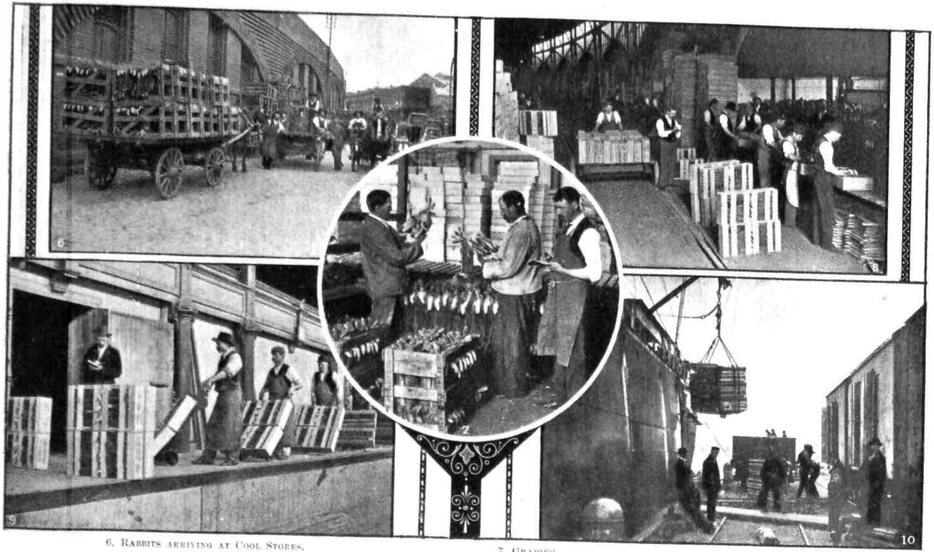
To enable all to appreciate the advice just given as to the time of spraying, it may be said that the object of the treatment is to kill the spores of the fungus which are entangled in the bud scales, and this is more easily done when they are commencing to germinate. The spore itself has a tough coat and is much less readily destroyed by contact with poisons when in a state of complete rest, as in midwinter, than when germinating or about to germinate in the early spring. Researches by J. F. Clarke have shown that a germinating spore has a certain solvent action upon dried deposits of copper compounds with which it may be in contact, and in fact the process of germination itself sets free the poison which kills the spore. Thus it is seen that by spraying

too early, when the tree is quite dormant, we are applying the fungicide long before it is wanted, and in addition subjecting it to the influence of rain and other agencies likely to wash it off or destroy its usefulness.

HOW TO SPRAY.

It is well to note that good results can only be insured by the use of properly prepared mixtures applied with good machines. A first-class pump, easily worked and not liable to get out of order, is an absolute essential. With Copper-Soda or Bluestone a very fine nozzle can be employed, as there is no grit to cause stoppages. In using Bordeaux a nozzle easily cleaned is very desirable, though thorough straining will be found to greatly reduce the possibility of choking. A fine spray, lightly coating the whole of the tree and particularly the growing shoots and the fruit buds, is what should be aimed at. The tree should not be drenched so that the mixture runs off in quantity, for it is found that in such cases a lesser quantity adheres, and this is why it is sometimes recommended to give two light sprayings at intervals of a few hours.

If the instructions given in this article regarding the manufacture of Bordeaux mixture, the time and method of application, are carefully followed, it is safe to say that no serious losses are likely to be sustained from the attacks of our more common fungus parasites.



6. Rabbits arriving at Cool Stores. 7. Grading. 8. Packing.

9. Packed Rabbits [illegible]

EXPORT OF FROZEN RABBITS.

In this month's issue is reproduced a series of photographs illustrating the operations which have to be conducted at the Government cool stores, in preparing the rabbits for shipment, after arrival from the country. The extent of the trade may be gauged from the following table supplied by Mr. Crowe :—

TABLE SHOWING QUANTITIES OF RABBITS AND POULTRY TREATED WEEKLY AT THE GOVERNMENT COOL STORES FOR THE SEASONS 1900–1, 1901–2—

Date.	Rabbits (Crates).		Poultry (Head).	
	1900–1901.	1901–1902.	1900–1901.	1901–1902.
Week ended—				
July 6 ..	2833	6120	710	6337
„ 13 ..	4710	5837	691	5832
„ 20 ..	3937	3951	470	4083
„ 27 ..	4086	3869	855	3145
August 3 ..	2994	2983	378	2748
„ 10 ..	2735	4337	166	1572
„ 17 ..	2418	3456	661	1323
„ 24 ..	1305	1662	651	327
„ 31 ..	..	1092	648	733
September 7 ..	1514	245	871	553
„ 14 ..	1595	296	435	897
„ 21 ..	1288	292	903	855
„ 28 ..	1219	156	850	466
October 5 ..	1234	210	1262	805
„ 12 ..	1198	163	1504	862
„ 19 ..	1180	59	2036	1394
„ 26 ..	1045	77	2591	2806
November 2 ..	1129	73	3561	2430
„ 9 ..	1048	194	2196	2364
„ 16 ..	912	186	953	1899
„ 23 ..	1362	233	793	2362
„ 30 ..	1586	404	2833	3482
December 7 ..	1634	601	2386	4483
„ 14 ..	1907	882	2179	5204
„ 21 ..	2487	963	2390	4222
„ 28 ..	384	687	207	..
January 4 ..	..	..	..	..
„ 11 ..	..	2643	..	600
„ 18 ..	1309	4175	443	1528
„ 25 ..	2025	4373	1980	2993
February 1 ..	2989	3990	1424	2400
„ 8 ..	3719	44 9	977	4195
„ 15 ..	2123	4670	840	3612
„ 22 ..	3590	5981	1549	4635
March 1 ..	2620	5033	2212	5159
„ 8 ..	2496	5156	1711	374[illegible]
„ 15 ..	3712	4524	2701	4352
„ 22 ..	3608	4302	2563	3702
„ 29 ..	3103	3148	2694	5152
April 5 ..	2376	1281	2910	2533
„ 12 ..	894	4652	162	2414
„ 19 ..	2972	5417	248	5541
„ 26 ..	1425	4192	892	4368
May 3 ..	3269	4538	3570	5527
„ 10 ..	2080	4982	1846	5790
„ 17 ..	3358	6146	541	5910
„ 24 ..	4395	7340	3514	5340
„ 31 ..	5067	7568	..	5711
June 7 ..	4809	5961	2352	5515
„ 14 ..	2828	4145	1389	3183
„ 21 ..	2877	4902	3328	1122
„ 28 ..	3521	2584	5343	948
Total	100,905	154,635	78,339	157,660

THE TRUE GRASSES OF VICTORIA.

By J. G. Luehmann, F.L.S., Government Botanist.

Introduction.

The Grasses constitute one of the largest natural orders of the vegetable kingdom, containing more than 3,000 different species. In our own cereals and the rice of warmer climes they furnish the most important food supplies of the globe, besides the greater part of pasture for domestic animals. As in other respects, our continent has not been blessed in this case with natural productions of pre-eminent value for cultivation, although those of the Old World give as good returns here as elsewhere. Still they have provided a natural supply of abundant and nutritious food for our flocks and herds; we may, therefore, reasonably suppose that after more extended and judicious trials some of them at least may turn out equal, if not superior, to the imported species now cultivated. Though some attempts have been made at the cultivation of our grasses—for instance, many years ago by Baron von Mueller in the Melbourne Botanic Gardens, by Mr. Bacchus near Ballarat, and more recently by Mr. F. Turner for the Agricultural Department of New South Wales, by Mr. H. Pye, the principal of the Dookie Agricultural College, and several others—yet these trials have not been sufficiently exhaustive, nor extensive, to give absolute proof of their value for general systematic cultivation, and we are still very much in the dark concerning their adaptation for artificial raising.

The following pages can, therefore, only supply in the main such information as we possess on their value in a natural state, as well as give the simplest botanical characters to enable those interested in the subject to recognise the different species. It has been deemed advisable to include also the introduced kinds, they being frequently so abundant as to appear indigenous, but they will be distinguished from the native species by being printed in italics.

The Grasses, or Gramineae, belong to the Monocotyledons, which, as the name implies, have only one cotyledon, and thus on sprouting throw up only a single leaf, while the Dicotyledons, to which most of our trees, shrubs, and other plants pertain, have two, or rarely more, seedling leaves. Their nearest allies are the Sedges, or Cyperaceae, from which they are most readily distinguished by the leaf-stalks which clasp the usually hollow flower stem, being slit open, while those of the Sedges are quite closed and the stem solid. The flowers of grasses are inconspicuous, the male and female organs in most cases being in the same flower. The petals of the ordinary flowering plants are either quite absent or represented by minute organs, called lodicules, around the pistil. The stamens and pistil are, however, surrounded by two or more green or scarious scales, termed glumes or bracts. The flowers are arranged in what are called spikelets, each spikelet bearing one or more flowers, and the spikelets form a head or spike or panicle. The flowers have as a rule three stamens, rarely more or less; the pistil has nearly

always a two-branched feathery stigma and a one-celled ovary with one seed. The leaves are alternate and have parallel veins; they clasp the stem at their base, but the base is open opposite to the blade; attached to the lowest part of the inside of the blade there is often a thin membrane, either entire or fringed, called a ligula, which is sometimes of importance for distinguishing a species.

The Grasses are generally divided by modern botanists into two sections, the Panicaceae, which are jointed in the inflorescence below the two lowest glumes, and the Poaceae, which are jointed above them. Thus, for instance, in the familiar genus Sorghum, belonging to the first, we find that on being threshed the whole flowering part falls off; while in oats or wheat, which belong to the Poaceae, the two lowest glumes remain attached to the stalk. However, this character is not always readily distinguishable, and in some cases does not hold good at all; I have, therefore, preferred in this little work to follow Baron von Mueller in his "Key to the System of Victorian Plants," by dividing our species into those that bear one grain to each spikelet and those that bear two or more grains. In other respects Bentham and Hooker's Genera Plantarum, the Flora Australiensis, and Hackel, in Engler's Pflanzenfamilien, have been taken as a guide.

The illustrations were executed by two artists jointly, Mr. L. Lang having drawn the main figures and also lithographed the plates, while Mr. J. P. Eckert drew the analytic details. Both gentlemen spared no pains to render the representations life-like, and I think it will be admitted that they have performed their part of the work in an excellent manner.

A "Key" to the genera for the use of those who wish to study the subject will be given at the end of the work.

IMPERATA, Cyrillo.

Spikelets usually in pairs, one nearly sessile, the other distinctly stalked, on the short branches of a long cylindrical spike-like panicle; one-flowered or rarely with a second imperfect flower. The two outer glumes rather long and hairy; the third smaller, nearly glabrous; the flowering glume still smaller; all awnless. Palea broad. Stamens usually two. Styles at first connate at the base, afterwards distinct. Grain small, free, but enclosed in the glumes.

A genus of only a few species in the warmer parts of the ,lobe.

I. arundinacea, Cyrillo.

THE LALANG GRASS, ALSO CALLED BLADY GRASS.

A coarse, stiff, perennial grass, the culms attaining a height of four feet, the leaves narrow, the lower ones nearly as long as the culms, the upper shorter, all with rough margins. Panicle cylindrical, up to eight inches long and nearly an inch in diameter, silvery white except the protruding dark stigmas. Spikelets about two lines long, enveloped by the long hairs of the outer glumes. Lowest glume five or seven nerved; the second three or five nerved; the third and the flowering

glume nerveless. (Bentham, "Flora Australiensis," VII., 536; F. v. Mueller, "Key to Plants of Victoria," I., 481, also "Select Plants;" Maiden, "Grasses of New South Wales," and many others.)

The Lalang grass is a native of all the Australian colonies, as well as of many other warm regions of the world. It occurs in most parts of Victoria except the mountains, and is very conspicuous in a paddock on account of its large white flower spike. It is by no means a good fodder grass, on account of its hardness, though stock will eat it in a young state, especially after a bush fire. It has often been used with advantage for thatching. It is also useful for binding sand in moist localities. On account of its strong roots it is difficult to eradicate.

Explanation of Plate.

Fig. 1, portion of the leaf where it encircles the stem; 2, flowers; 3, stamens and pistil; 4, 5, 6, glumes; 7, separate stamen; 8, separate pistil. All enlarged, but in varing degrees. The main figure of the flowering spike has been surrounded by a dark border, in order to show its whiteness.

POLLINIA, Trinius.

Spikelets usually in pairs, one sessile or nearly so, the other distinctly stalked, one-flowered. Glumes three or four, the lowest the largest, truncate or ciliate, with two nerves; the second glume thinner, keeled, acute; the third generally deficient; flower-bearing glume with a twisted and bent awn. Palea small, or absent. Lodicules two. Styles distinct. Grain enclosed in its glume, but not adnate.

The genus is distributed over the warmer parts of the world. The Victorian species is endemic in Australia.

P. fulva, Bentham.

P. Cumingii, Nees, var. fulva, according to Hackel.

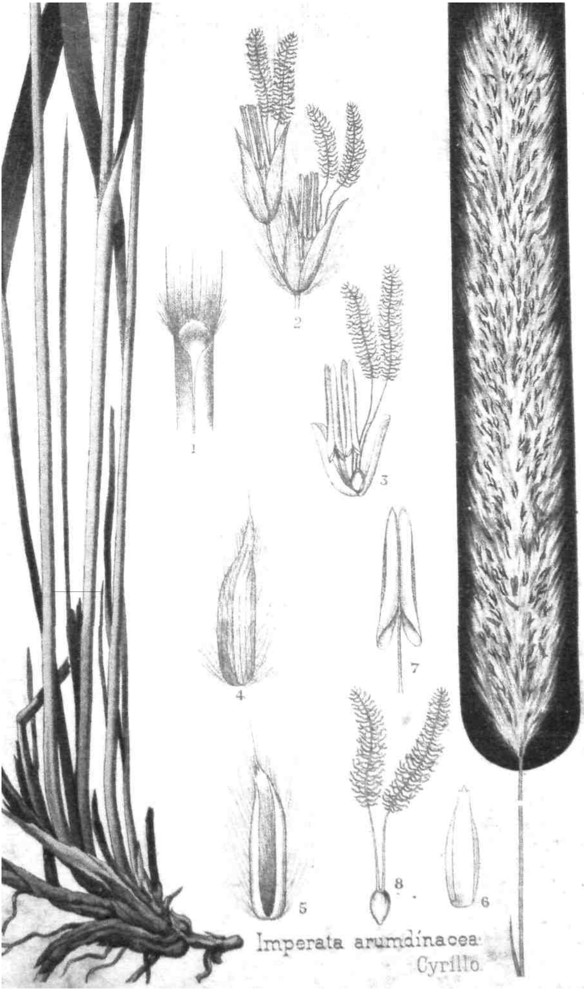
Sugar grass, also known by several other vernacular names. Perennial, attaining a height of four feet, but generally smaller. Leaves narrow, the sheaths sometimes hairy, the ligula ciliate. Spikes generally two or three, rarely five, or only one, in a terminal cluster, covered with brown silky hairs; spikelets about two lines long. Awn of the fertile glume small.

In Victoria confined to the north-western districts, extending thence to Northern and Western Australia, principally in the interior.

A sweet nutritious grass, withstanding drought well. Mr. F. M. Bailey and others testify to its good qualities as a fattening and palatable grass, especially for cattle. It seeds pretty freely, and deserves, therefore, special attention for cultivation, particularly in the drier and warmer parts of Victoria.

ROTTBOELLIA (Linn. f.)

Spikelets in pairs, in the alternate notches of a simple spike (in the Victorian species), one sessile and half imbedded in a cavity of the rhachis with one hermaphrodite flower, the other shortly pedicellate



Imperata arundinacea
Cyrillo

Rottboellia compressa.
Linn. fil.

and sterile, consisting of empty glumes. Glumes in the fertile spikelet four; the outer one coriaceous, appressed, and covering the cavity of the rhachis; the second thinner; the third and fourth quite thin. Lodicules two, cuneate. Stigmas laterally exserted. Grain enclosed in the glumes, but not adnate.

The genus is principally represented in the warmer parts of the world. I have followed Professor Hackel in including the genus Hemarthria under Rottboellia.

Rottboellia compressa (Linn. f.)

(Hemarthria compressa, R. Brown; Bentham, "Flora Australiensis," VII., 510; F. v. Mueller, Key I., 108.)

MAT-GRASS.

A creeping grass, with rather thick, somewhat compressed stems, attaining a foot or more in length. Leaves narrow, glabrous or sprinkled with a few long hairs. Spikes solitary on the branches or nearly so, more or less compressed, rigid, 3 to 5 inches long, often one and a half lines broad. Spikelets all closely appressed, three to three and a half lines long. Outer glumes many-nerved, tapering into a very variable point, sometimes elongated and fine, or minutely hooked at the extremity, or more frequently with a rather long and rigid hook. In the pedicellate spikelet the point of the outer glume is often longer, finer, and straight; but occasionally that also is hooked, and more rarely the second glume ends in a small hook.

This grass is found all over Australia on the banks of water-courses and swamps, even where the water is brackish; it thrives best in summer, and affords then nutritious and palatable feed for cattle and horses. It is excellent for consolidating soft embankments with its strong creeping roots, but it is a very shy seed-bearer. I have examined at least 50 specimens from different localities without finding a single perfect seed, it will therefore have to be propagated from cuttings like Buffalo grass.

EXPLANATION OF PLATE.

Fig. 1, portion of leaf where it encircles the stem; 2, portion of the flower-spike; 3, a flower; 4, glumes; 5, flower, the outer glumes removed; 6, pistil, showing the lodicules.

ANTHISTIRIA (Linn. f.)

Spikelets, one-flowered or empty, generally seven in a spike or cluster, the four lowest in a whorl at the base of the hairy rhachis either male or barren, two other stalked spikelets, either male or barren, at the top, and with a sessile fertile one. Glumes in the sterile spikelets usually two, the outer one several-nerved, the inner one thin and hyaline; in the male spikelets usually a smaller third glume. Glumes in the fertile spikelets four, the two outer ones nearly equal, rigid and coriaceous; the lowest dark brown; the third much smaller, thin and hyaline; the fourth very narrow and thin at the

base, thickened into a long-twisted awn, bent above the middle. Palea very small, or none. Lodicules two. Styles exserted. Grain free, enclosed in the hardened outer glumes.

The genus, of which there are not many species, is found in many of the warmer parts of the world.

Anthistiria australis, R. Brown.

(A. ciliata, Bentham and Mueller, not L. f. Themeda Forskalii, Hackel.)

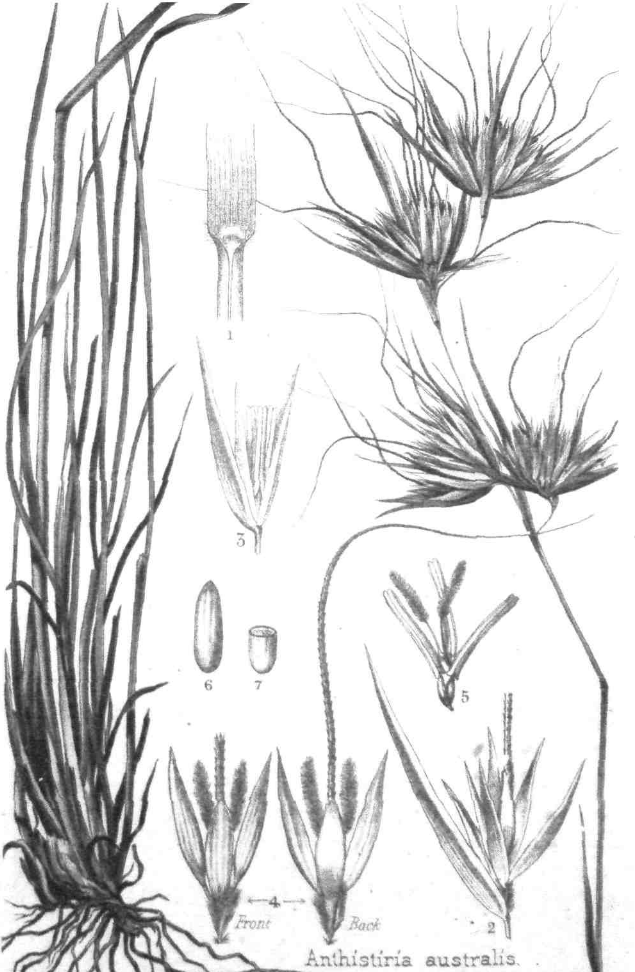
THE ORDINARY KANGAROO GRASS.

Perennial, from 1 to 6 feet high. Leaves rather narrow, glabrous, or the sheaths hairy; ligula very short. Clusters of spikelets not numerous, sessile, or the lower ones stalked, in a short terminal leafy panicle, the leafy bracts subtending each spike, sheathing at the base, and tapering into points longer than the cluster; the short rhachis bearded with long brown hairs. Spikelets narrow, four or five lines long, four male or barren ones sessile at the base of the rhachis, two pedicellate male or barren ones at the top, mostly glabrous. Fertile spikelet glabrous; the outer glume broad, obtuse, about seven-nerved; second shorter, glabrous, with two prominent lateral nerves and a faint central one; the third very thin; the fourth with a long rigid awn. The grains are, at least here, frequently not properly developed.

This, our well-known kangaroo grass, was included by Bentham, F. v. Mueller, and other botanists under Anthistiria ciliata; but that species is, as shown by Professor Hackel, an annual, and differs besides in other characters, so that R. Brown's name must be restored. It is found all over Australia, and extends also to Asia and Africa. According to the "Index Kewensis," the species should be called A. imberbis, but then the authors quote only South Africa as its habitat. The kangaroo grass is almost the only one of our native grasses generally known by every one of our graziers and farmers. Wherever it grows it is highly appreciated for all kinds of stock, at least in its young state, and it has the advantage of springing up quickly and vigorously after a fire has swept over the ground. Its disadvantages are that it is easily quite eaten out, especially by sheep, and that it is a bad seed-bearer; for this reason it seems very doubtful whether it can ever come into systematic artificial cultivation. It is, however, remarkable how quickly it reappears after it seems to have been quite eaten out by stock, if the land is unoccupied for a season or two. The late Professor Tate informed me that cattle will hardly look at it in Northern Australia when it has attained a rank coarse growth.

EXPLANATION OF PLATE.

Fig. 1, portion of leaf encircling the stem; 2, cluster of spikelet (with supporting leaf), showing the fertile flower and the six sterile flowers; 3, male spikelet; 4, fertile spikelet, with two sterile ones; 5, stamens, pistil, and lodicules of a fertile spikelet; 6, seed; 7, transverse section of seed. All enlarged, but in varying degrees.


1
3
6
7
5
4
Front
Back
2
Anthistiria australis.
R. Brown.

TRAGUS, Haller.

Spikelets sessile or nearly so, two to four or rarely five, in clusters along a spike-like panicle; not awned. Glumes three, the lowest very small or sometimes wanting, the second large with five prominent nerves and armed with hooked bristles; the flowering glume thin, three-nerved. Palea membraneous, two-nerved, about as long as the flowering glume. Grain enclosed in the glume and palea, but free. Only two species of this genus are known.

Tragus racemosus, Haller.

SMALL BURR-GRASS.

An annual, at least with us, up to a foot high, generally decumbent, nearly glabrous. Leaves short, flat, rigid, glaucous, the ligula short, ciliate. Spike-like panicle 2 to 4 inches long, the very short branches bearing two or rarely three spikelets, the latter falling off together like little burrs. Lowest glume minute; second glume incurved, strongly armed with prickles, enveloping the flowering glume, palea, and grain till all drop off.

Indigenous in all the States except Tasmania and West Australia; also found in many other parts of the warmer regions.

The small burr-grass is harsh and unimportant for pastoral purposes. It is, however, considered nutritious, and Mr. Bailey esteems it a useful species for Queensland in the cool season. In Victoria it is only met with in the Mallee district, where it is appreciated by some on account of its drought-resisting qualities.

Illustrated in Mr. Maiden's "Manual of the Grasses of New South Wales."

NEURACHNE, R. Brown.

Spikelets one-flowered, not awned, sessile along a simple ovoid spike. Glumes four, the lowest small; the second the largest, fringed in the lower half on the intramarginal nerve with long, spreading hairs; the third smaller and thinner. Fruiting glume small and thin; the palea about as long, very thin. Styles distinct. Grain enclosed in the glume and palea, but free from them.

The genus has only three species, endemic in Australia.

Neurachne alopecuroides, R. Brown.

(Bentham, "Flora Australiensis," VII., 507. F. von Mueller, "Key to Plants of Victoria," I.)

THE MULGA GRASS.

Generally annual, but sometimes lasting longer, rarely exceeding one foot in height, the stems tufted with hairy nodes. Leaves rather short, narrow and rigid, mostly at the base of the stem, glabrous except the dense hairs of the ligula. Spike ovoid, under one inch long; spikelets numerous, densely crowding around the rhachis, spreading, readily falling away, a few at the base barren and more

persistent than the others. Spikelets about three lines long, with a tuft of hair at the base. Outer glume short, five or seven-nerved; second glume many-nerved, tapering to a fine point, densely covered with long hairs on each side; third glume smaller, with fewer nerves, sprinkled with a few short hairs. Fruiting glume and palea thin and hyaline.

Habitat: From Western Victoria and New South Wales to West Australia.

Illustrated in Maiden's Manual, page 66.

This grass is chiefly found in dry, barren country, and is naturally of a hard nature. Mr. Tepper, of South Australia, speaks of it as a useful summer grass in places where little else will grow. We know, however, very little about it, but it is not likely to become of any importance for cultivation.

ZOYSIA, Willdenow.

Spikelets one-flowered, not awned, nearly sessile in a close spike; not distichous; the rhachis continuous. Glumes two; the outer one broad, complicate, keeled; the inner flowering one much smaller, thin, and hyaline. Palea still smaller. Styles distinct. Grain free, enclosed in the somewhat hardened outer glume.

The genus consists of only two or three species.

Zoysia pungens, Willdenow.

(Bentham, "Flora Austral." VII., 506. F. von Mueller, "Key to Plants of Victoria," I.).

PRICKLY COUCH GRASS.

A perennial grass, the roots creeping along the coast sands to a great extent, the erect stems not above six inches high. Leaves flat or convolute, with rigid (often pungent) points, glabrous except a few hairs at the orifice of the rather loose sheaths. Spike slender, one to one and a half inches long; spikelets erect, closely appressed in the notches of the rhachis, one and a half to two lines long. Outer glume rather acute, broad, smooth, and shining, the sides nerveless; flowering glume completely enclosed, usually much smaller, thin, and hyaline, but sometimes more than half the size of the outer one, and somewhat rigid.

Figured by Mr. Buchanan.

Habitat: Coasts of Eastern Australia, New Zealand, and Asia.

The prickly couch grass is of some importance for binding coastal sands, on which it forms a pretty close turf, and deserves attention for this purpose. Though the foliage is harsh, stock will eat it. It can be propagated by roots as well as from seeds; these are, however, not produced in abundance, at least with us.

GENERAL NOTES.

Colouring Matter in Dairy Produce.

The most commonly used colouring matter for dairy produce is annatto, a vegetable extract from *Bixa orellana*. This, and certain other yellow colouring matters of vegetable origin, turmeric, saffron, &c., have generally been considered harmless in the quantities employed, but they are being gradually superseded by coal-tar yellows, the action of which on the human system is not fully known. Butter, from Holland, Australia, and the United States is very frequently coloured with coal-tar yellows. A large number of margarines are also so coloured. The coal-tar yellow, most frequently employed for dairy produce and margarines, is known commercially as "butter yellow" (*Dimethyl-amido-azo-benzene*), and is generally supplied ready dissolved in oil, either cotton seed, rape, linseed, or sesame oil. Tropœolins, derived from coal-tar, are also coming into use.—*Journal of the Board of Agriculture.*

Manures for Grass Land.

Some interesting experiments, which have been conducted during the last few years, in checking the grass-destroying fungus (*Isaria*) by means of manures applied in the early spring, have thrown much light upon the question whether it would pay to manure grass land. The Messrs. Brittlebank, on whose farm at Myrniong these experiments were conducted, have been so satisfied with the results obtained on the plots, ranging in size from one-half to one acre, that they have decided to apply a dressing of 28 lbs. per acre of sulphate of ammonia to a large portion of their pasture. Experience has shown that this quantity is sufficient to promote a very heavy growth of grass, and, if used towards the end of the winter, would largely increase the amount of feed available, while the effect is very noticeable in the extra growth the following autumn. The soil in question is comparatively rich in phosphates; other lands less favoured might require, in addition, a small amount of superphosphate. The 28 lbs. of sulphate of ammonia costs about 3s. 6d. per acre.

A New Fungicide.

In the *Farmers' Bulletin*, No. 78, issued by the United States Department of Agriculture, is described the process of manufacture of a new fungicide, named Sar, said to be very effective. It is made as follows:—"Place 15 lbs. of flowers of sulphur in a barrel, mix thoroughly with ½ lb. of finely powdered resin, stir well with 3 quarts of water, which should make a thick paste. The paste must not be thin and watery, nor so dry as to crumble to powder when stirred. Then add 10 lbs. of caustic soda, and stir well. After from three to fifteen minutes the mass turns a reddish brown and boils violently, and must be stirred well, preferably with a broad paddle, to prevent it from running over. After it has ceased boiling, add slowly

about 2 gallons of water (hot if possible, but cold will do), and then carefully pour off into another vessel marked to hold 6 gallons, and add hot water till the 6-gallon mark is reached. This gives a stock solution, which must be kept in tightly corked jugs, or in closed barrels or kegs, since it spoils if it comes into contact with the air. It is also decomposed if it touches metals." Of this stock solution, 1½ pints to 50 gallons of water is recommended for treating seed oats for loose smut, the seed to be soaked for 24 hours. A stronger solution, 1 gallon in 50 of water can also be employed, in which case two hours will be sufficient for soaking.

To Detect Formaldehyde in Milk.

This preservative, which is absolutely prohibited from use in milk in nearly all countries, is easily detected by the following method, introduced by A. G. Leubert. Place five grammes of coarsely powdered potassium sulphate in 100 c.c. flask, distribute five c.c. of the milk over the crystals with a pipette, and gently pour down the side of the flask ten c.c. of sulphuric acid (sp. g. 1·84). If formaldehyde is present the crystals *of potassium sulphate will become violet in a few minutes, the colour* gradually diffusing through the liquid. When there is no formaldehyde present, the colour at once becomes brown and then rapidly black. This test is sensitive to one part of formaldehyde in 250,000 of milk.

Paris Green.

Complaints are often made about the quality of Paris green sold for destroying leaf-eating insects. A simple and efficient method of testing its purity is to place a portion of the powder in strong ammonia, when, if pure, it will completely dissolve, forming a clear dark-blue liquid. Any insoluble residue is to be regarded as an impurity. Chrome green, which is often substituted for Paris green, is insoluble in ammonia.

Arsenite of Soda.

This valuable insecticide for leaf-eating insects, which may be employed in place of Paris green, is made in the following manner. Place 2 lbs. of commercial white arsenic and 4 lbs. of washing soda in about a gallon of water, and boil for a quarter or an hour, or until the liquid is quite clear. Make up to 2 gallons and label "POISON." One pint in 40 gallons of Bordeaux mixture, or of lime water (made by adding 4 lbs. of lime to 40 gallons of water) is a convenient strength for use.

Killing Weeds with Chemicals.

In Lancashire, England, experiments were recently carried out by F. B. Walker, at the County Council farm, to test the effect of solutions of bluestone and iron sulphate as sprays upon the growth of the injurious weed charlock, or wild turnip, which does much harm in the clover-fields of the old country. This weed belongs to the same family as the cabbage and mustard, and serves to harbor several serious diseases of the cultivated plants of this order, and particularly the dreaded club root of the cabbage, cauliflower, and turnip.

A piece of land was selected and sown with charlock seed, mixed with clover and grass. After the young clover and charlock plants were well up, the latter being about 2 to 3 inches high and thick on the ground, some of the plots were sprayed in fine weather with a solution of 3 lbs. of bluestone in 10 gallons of water, and others with 12 lbs. of iron sulphate in the same quantity of water. About 50 gallons per acre were required, and the horse-power field-sprayer, known as the Strawsoniser, was used to distribute the material. One plot was left unsprayed for comparison, and, though no difference was observed the first day in the condition of the various plots, yet on the second day it was seen that the sprays had very seriously burnt the charlock and the clover itself was slightly checked. After a week the clover had quite recovered, and, a few days after, a second similar spraying was given to the plots, the previously unsprayed plot being again left alone. On the latter plot, at the time of the second spraying, the charlock had grown so rapidly as to completely overshadow the clover, while in the sprayed plots there was so little charlock that the clover received nearly all the spraying solutions. In a few days almost all the charlock was destroyed, and, though the clover received a decided check, in a fortnight this was quite overcome and vigorous growth was being made. The contrast between the sprayed and the unsprayed was so striking that the produce from each plot was cut and weighed. The plot sprayed twice with bluestone yielded 84 lbs. of clover and grass and less than ¾ lb. of dried charlock, with ¾ oz. of seed of the latter. As against this the unsprayed gave only 16 lbs. of clover and 20¾ lbs. of dried charlock, with 71¾ oz. of charlock seed. The sulphate of iron, though giving good results, did not prove so efficacious as the bluestone, and is besides less convenient in use.

These results, taken in connexion with others on barley and oat crops, where also great success was achieved, seem to indicate that some, at least, of our injurious weeds may be kept in check, if not entirely destroyed, by various sprays. The efficacy of the solutions in the experiments here noted appeared to be largely dependent upon the nature of the leaves of the sprayed plants. Those with hairy leaves were very seriously damaged or killed outright, while the smooth-leaved plants were often quite uninjured. Thus, the form of charlock, without hairs on the leaves, was found not to suffer to any great extent from the bluestone solutions. It would be interesting to try the effect of these sprays upon some of our local weeds, especially the hairy thistles.

Pie Melons for Stock.

The pie melon, held by some to be a cross between the citron and water melons, is of much value as a stock food. It succeeds well in districts too dry for the pumpkin. Light, rather than heavy soils, are preferable for this crop, and even in dry seasons seed sown in early spring has been known to return 20 tons per acre. In good years, yields as high as 40 tons have been obtained. Sheep and cattle eat these melons with avidity, but, on account of the tough rind, they should be cut into several pieces before feeding to stock.

Prizes for Colonial Butter at Islington.

Mr. J. M. Sinclair has forwarded particulars relating to the show to be held in the Agricultural Hall, Islington, London, by the British Dairy Farmers' Association, on October 7th, 8th, 9th, and 10th. It has been decided to offer prizes for Colonial butter, each entry to consist of one box, containing not less than 56 lbs. The entry fee has been fixed at 10s.

The prizes offered are as follows :—

Colonial butter, salt (one box of 56 lbs.)—

First prize ...	... £5 and silver medal.
Second prize ...	... £3 and bronze medal.

Entry forms have been forwarded to the Secretary for Agriculture, to whom application should be made, and Mr. Sinclair has undertaken to look after any exhibits should competitors wish him to do so. It is very desirable, in the interest of the butter export trade, that a good number of entries should be received. Victoria, having the largest share of the trade in the Australian States, should at least carry off the first prize, and many will be dissatisfied if both the medals do not come to this State.

Moisture in Butter.

BOARD OF AGRICULTURE RULES.

(Dated 22nd April, 1902.)

SALE OF BUTTER REGULATIONS, 1902.

The Board of Agriculture, in exercise of the powers conferred on them by Section 4 of the *Sale of Food and Drugs Act* 1899, has made the following Regulations :—

1. Where the proportion of water in a sample of butter exceeds 16 per cent. it shall be presumed for the purposes of the Sale of Food and Drugs Acts 1875 to 1899, until the contrary is proved, that the butter is not genuine, by reason of the excessive amount of water therein.
2. These Regulations extend to Great Britain.
3. These Regulations shall come into operation on the 15th day of May, 1902.
4. These Regulations may be cited as the Sale of Butter Regulations, 1902.

EXPORTS.

PARTICULARS OF FROZEN PRODUCE exported from Victoria from 20th May, 1902, to 20th June, 1902.

Description of Produce.		Through Government Cool Stores.	Through other Cool Stores.	Total Quantity Shipped.
Butter (Victorian)	lbs.	67,032	...	473,674
,, (Inter-State and Bond) ...	,,	287,112	119,530	
Milk and Cream (Concentrated) ...	cases	846	...	846
Cheese	lbs.	...	8,520	8,520
Poultry	head	240	...	240
Eggs	dozen	13,953	...	13,953
Lamb and Mutton	carcasses	638	700	1,338
Calves and Pigs	,,	19	...	19
Beef	pieces	160	...	160
Fruit	cases	300	673	973
Sundries	lbs.	7,978	538	8,516

R. CROWE,
Dairy Expert.

SUMMARY.

MONTHLY RETURN of Farm Products Exported and Certified to from 21st May to 21st June, 1902.

Shipped to.	Number.	Products.	Approx. Weight.
		WAR OFFICE CONTRACT.	
			Tons cwt. qrs. lbs.
South Africa ...	20,888 bales ...	Compressed fodder ...	788 4 1 10
		Private Shipment.	
			Tons cwt. qrs.
South Africa ...	700 bales ...	Compressed chaff ...	25 0 0
,, ...	494 bags ...	Rolled oats	1,400 bushels
			Tons cwt. qrs.
,, ...	4,151 ,, ...	Potatoes	346 0 0
,, ...	5,450 cases ...	,, ...	220 0 0
,, ...	285 bags ...	Onions	16 0 0
New South Wales ...	6,822 bales ...	Oaten hay	300 0 0
,, ...	9,531 bags ...	Chaff	340 0 0
,, ...	609 ,, ...	Potatoes	50 0 0
,, ...	928 ,, ...	Onions	62 0 0
Queensland ...	835 ,, ...	Potatoes	70 0 0
,, ...	559 ,, ...	Onions	38 0 0
,, ...	13 ,, ...	Peas	45 bushels
			Tons cwt. qrs.
West Australia ...	957 ,, ...	Potatoes	80 0 0
,, ...	134 ,, ...	Onions	9 0 0
,, ...	181 ,, ...	Oats	720 bushels
,, ...	54 ,, ...	Peas	220 ,,
			Tons cwt. qrs.
South Australia ...	301 ,, ...	Potatoes	25 0 0
India	50 bales ...	Chaff	8 0 0

J. KNIGHT.

EXPORT OF FRUIT.

Return showing number of cases of Fruit, Plants, and Bulbs inspected for export to Australian States and New Zealand only, for month ending 20th June, 1902 :—

Name of Fruit, &c.	Number of Cases Inspected.	Number of Certificates Issued.
Apples	149	39
Bananas	1,180	285
Grapes	121	33
Lemons	332	96
Melons	69	6
Oranges	509	144
Passion Fruit	93	32
Pears	18	6
Persimmons	6	5
Pine Apples	106	77
Pomegranates	1	1
Quinces	13	9
Plants	126	71
Bulbs	6	5
Totals	2,729	809

Return of Fruit Inspected for Export to ports beyond the Australian Commonwealth, for Month ending 20th June, 1902 :—

South Africa—

Apples ... ... 102 cases.

J. G. TURNER.

RAINFALL IN VICTORIA.

MONTH OF MAY, 1902.

By P. Baracchi.

Areas.	Actual Average Rainfall recorded in each Area, in May, 1902.	Average Rainfall for each Area for the Month of May, based on all previous years of record.	Maximum Fall recorded within each Area during May, 1902.
	Inches.	Inches.	Inches.
A	0·20	1·32	0·31 at Rainbow
B	0·72	1·93	1·20 " Serviceton
C	1·16	2·62	2·23 " Koroit
D	1·39	3·20	1·76 " Port Campbell
E	0·17	1·77	0·52 " Kerang
F	0·04	2·55	0·10 " Chiltern
F1	0·25	2·93	0·57 " Yea
F2	0·08	3·69	0·14 " Beechworth
G	0·40	2·55	0·65 " Yandoit
H	0·86	3·17	1·06 " Daylesford
I	0·95	2·29	1·84 " Grantville
I1	1·44	3·16	1·59 " Cape Schanck
K	1·33	3·91	2·64 " Warburton
L	0·43	2·06	0·67 " Alberton P.O.
M	0·78	4·14	0·78 " Gabo

Subdivisional Areas of the State of Victoria, representing typical Distribution of Rainfall.

A. North-west—Mallee country, including the counties of Millewa, Taila, Weeah, and Karkarooc.

B. Central West—Including the counties of Lowan and Borung.

C. Western Districts—Including the counties of Follett, Dundas, western half of Ripon and Hampden.

D. South-western Districts and West Coast—Including the counties of Normanby, Villiers, Heytesbury, and Polwarth.

E. Northern Country.—Including the counties of Tatchera and Gunbower, and the northern half of Kara Kara, Gladstone, and Bendigo, and the north-west portions of Rodney and Moira.

F. Northern Country—Including the greater part of the county of Moira, the north-eastern quarter of the county of Rodney, and the extreme north-west of the county of Bogong.

F1. Central North—Including the county of Anglesey, the west and northern parts of the county of Delatite, the extreme south of the county of Moira, and the south-east quarter of Rodney.

F2. Upper Murray—Districts from Wodonga to Towong.

G. Central Districts North of Dividing Ranges—Including counties of Talbot and Dalhousie, southern half of the counties of Kara Kara, Gladstone, and Bendigo, and the south-west quarter of the county of Rodney.

H. Central Highlands and Ranges from Ararat to Kilmore.

I. South Central Districts on the west and north side of Port Phillip Bay—Including the counties of Grant, Grenville, and Bourke, and the eastern parts of the counties of Hampden and Ripon.

I1. South Central Districts east of Port Phillip Bay, &c.—Including the counties of Mornington and Evelyn.

K. *Regions of Heaviest Rainfall—including all the mountainous Eastern Districts, and* South Gippsland.

L. South-eastern Districts—Gippsland, and counties on the New South Wales Border.

M. Extreme East Coast.

ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE.

A REVIEW OF THE YEAR'S WORK.

By the Director of Agriculture.

Before reviewing the Annual Reports of the officers in charge of the various branches of the Department, I beg leave to thank the Honorable Mr. Morrissey, the late Minister of Agriculture, and the officers of the Department for the kind manner in which they received me when I came to Victoria as Director of Agriculture. To come to a new country without any local experience, and to enter into the administration of a Department without any knowledge of the Regulations in force or customs that had previously been observed, would have been a difficult task had I not met with almost universal good feeling and loyal support.

The Department is thoroughly well manned and does an amazing amount of work for the money spent. The Estimates and Supplementary Estimates for 1901–2 were £59,998; deduct from this £33,850 for the export trade, a money-earning business, and £9,350 grants given to Associations, &c., and you have only £16,798 on the Estimates for the benefit of Agriculture out of a total revenue of nearly £7,000,000. These figures require no remark, they speak for themselves.

The Journal of Agriculture.

The publication of the monthly *Journal of Agriculture* is one of the most important advances that has been made by the Department of Agriculture for some time. It is a medium by which all work of the Department can be brought prominently before the farming community and the scientific world. The Department need not fear criticism if the work of the staff is known to the public. Officials have a new incentive to do their work thoroughly, knowing that they can record their doings in a *Journal* read by 6,000 people. Last year's Annual Reports were published only last month, while those for this year appear in the present number of the *Journal*, and consequently will be read with interest and profit.

The cost of the *Journal* is considerable, yet, when we consider that all bulletins to be issued by the Department will first appear in the *Journal*, thus saving initial cost of bulletins and reports, the addition to the annual printing bill will be trifling. The *Journal* was ably launched by the late editor, Mr. Potts, and still maintains the same high standard in the hands of Mr. McAlpine.

Chemistry.

The work of the Chemical branch and the possibilities of development in the future have been ably described by Dr. Howell, and is well

worth close study. It would be useless for me to discuss in detail this or any other of the reports, as such a course would lead only to repetition. Whatever may be necessary in the future, this is at present a thoroughly well-organized branch of the Department, showing evidence of the indomitable perseverance and thoroughness of its founder, and the capacity of the present head to develop the good work so wisely begun.

Never was there a time in the existence of the State in which chemistry will be able to do more for its prosperity than at the present moment. Farmers are now beginning to realize thoroughly the necessity for manures. They have been unaccustomed to their use, and require guidance as to what manure to apply for each crop with due consideration to soil and district. Little past experience is available to guide them, and the money that will be lost in applying the wrong manure and manuring in unprofitable quantities and proportions is sure to be considerable, however energetic the Department may be in giving assistance. Nothing is more surprising to one accustomed to European practice than the striking results obtained by the application of a small quantity of superphosphate to the grain crops in the Northern area, and the total want of results when nitrogenous manures are applied. A knowledge of these two facts is worth many thousands of pounds per annum, and yet Victoria is without an Experimental Farm, where hundreds of other facts of perhaps equal importance could be demonstrated.

The rapid increase during the last year of samples of soils and manures sent in for analysis shows that farmers are alive to the necessity for gaining information. The Chemical laboratory is cramped and unsuitable, and the fittings and apparatus are insufficient, yet the work done is thoroughly accurate and of a most useful character. The value of the manurial demonstration plots is thoroughly appreciated, and their extension, so as to include the growth of forage crops, is being entered upon this season. To my mind, this is one of the most useful developments that can be undertaken.

The exertions that have been made to prove that sugar beet can be grown profitably in the Southern areas have involved a great amount of work, and it is hoped that through the information gained the money spent on the Government Sugar Factory may not be entirely lost. However this may be, the experiments have proved to the satisfaction of many farmers that sugar beet is a profitable crop to grow and feed to stock, more especially to pigs and dairy cattle.

The testing of the milling qualities of different varieties of wheats and the effect of manuring on quality should be no longer delayed. The cost would be trifling, and can be accomplished by the present staff when the younger members who have recently joined have had a little more experience. The present method of recruiting the staff by students who are allowed to leave for lack of a trifling advance in pay cannot be too severely condemned. The time of the seniors is occupied in instructing these men, while their services are at first comparatively wor[illegible]

Viticulture.

The work of the Viticultural branch does not cover a very wide field when one considers what was hoped for some years ago. The college is without students, and the grapes from the vineyard have been sold instead of being made into wine. All nursery work at the viticultural station labours under the great disadvantage of being in a dry area, without any means of irrigation. There is, however, good work being accomplished by the small staff provided, the most important of which is the raising of American resistant stocks for distribution amongst growers. That there should be sufficient American stocks to distribute to those who intend planting new vineyards is the paramount duty of the Government, as it is only a matter of time until phylloxera will destroy all existing vineyards. The process is slow but sure, and so much has this been realized that the planting of new vineyards has almost ceased, and can only be revived when American resistant stocks are available. Mr. Dubois assures me that there are enough for present demands.

More important than quantity is the question of the varieties that should be planted on different soils and in different localities. There is no former experience to guide vignerons, and if vineyards are planted with vines grafted on American varieties unsuited to the locality serious loss will ensue. I would advise that no large areas should be planted for a few years, but that as many growers as possible should plant small areas of the variety they wish to cultivate which have been grafted upon those American stocks most likely to succeed in their soil and climate. Here, however, is the difficulty. What American stocks are the best for the locality? I have every confidence in Mr. Dubois' ability, but he has a great responsibility before him. Naturally and rightly vignerons will turn to him for advice, and it will depend largely on the wisdom of that advice whether the new vineyards are a success or not. Much of his time should be spent in studying this important question. Valuable literature, translated from the French, is now available, and will be of great service to those who are anxious to gain information.

Stock Inspection.

The Stock inspection of the State is conducted by men of experience, who, from their long association with stock are well able to diagnose those diseases which are prevalent. When severe outbreaks occur, or diseases appear about which there is any doubt, veterinary surgeons are called in to assist the inspectors. If the service was sufficiently manned, this system, as a whole, would work fairly well; but the fact that the inspectors are not veterinary surgeons lays this branch of the Department open to outside criticism. I am of opinion that men holding diplomas should be appointed in future. Men with scientific training especially those who have spent their youth in a country district, would soon gain experience in the work, and ought to make better inspectors in the long run. This, however, would not affect the promotion of efficient men already in the service.

A determined effort should be made to eradicate pleuro-pneumonia. The amount of Jersey blood in so many dairy herds is a fruitful source of tuberculosis. The Jersey is too delicate to stand the treatment that our dairy cattle are subjected to in winter, and ought to be got rid of as soon as possible. The Ayrshire and Shorthorn, or their crosses, will stand the climate infinitely better.

The death of cattle from the lack of phosphates in the soil, and consequently in the food, has been to a certain extent mitigated by feeding on bonedust. This is, however, a dangerous practice when bones are allowed to be imported from India and countries where "Anthrax" is prevalent. All bones imported into the State should be manufactured into superphosphate by treatment with sulphuric acid, and bones of animals killed in Victoria alone made into bonedust.

The spread of fowl tick in the Northern district is a matter that will require careful handling. The interests of the whole State must first be considered; yet undue hardship on poultry-keepers in the quarantined areas is to be deprecated.

Entomology.

The work of the Entomological Branch has been ably conducted by Mr. French, although much of his time has been occupied in doing work which should, if money had been available, have been intrusted to others. Although a large correspondence on scientific subjects requires much time for reference and investigation, he is afforded no clerical assistance.

The supervision of the Inspectors appointed under the Vegetation Diseases Act should be done by a chief inspector, and the destruction of weeds with which he has been intrusted is the work of a botanist. It is an anomaly to have a Department of Agriculture without a botanist who could undertake this and other work which is at present given to others.

A most successful experiment is the introduction of the Locust Fungus, which, judging from the results of last year, will in all probability greatly minimize the Grasshopper pest.

Much has been done in advising fruit-growers how to combat insect pests, and I should like to see the Entomologist with more time at his disposal for investigation and experiment. Mr. French must have leisure to complete Part 4 of his valuable *Handbook of the Destructive Insects of Victoria.* This is a standard work, ably written, and highly appreciated by the public.

The inspectors appointed under the Vegetation Diseases Act are too few, and their districts are as a rule too extensive. Although much good work has been done, yet too long intervals between inspections renders the work futile in some cases.

Vegetable Pathology.

The success that has attended experiments conducted during the past year with the object of combating Fungus diseases has, in several instances, been most gratifying. There is nothing more disheartening

to a cultivator than to lose a good crop from a Fungus or Insect pest for which there is no known remedy.

Pastures infested with the grass destroying fungus *Isaria* have been rendered perfectly healthy by the application of sulphate of ammonia. It is yet to be seen if this will prove a lasting remedy.

The tobacco industry has long languished from the effects of *Blue mould*, and the efforts of the late Tobacco expert to improve the condition of the industry were frustrated in a great measure because there was little good tobacco to cure on account of this disease. It is highly satisfactory to find that Mr. McAlpine has at last settled this difficulty. Much has also been learnt as to the prevention of *Black spot* on apples. No doubt, it was previously known that the Bordeaux mixture was an efficient preventive, but the exact time of spraying, the proper strength of the mixture, and many other details were wanting. To experiment was the only way in which to settle these matters, and it is thoroughly satisfactory to find that the Vegetable Pathologist submits all his theories to practice before giving advice to growers. Advice of a general nature, without exact information gained through experiment and close attention to detail, is of little practical value. There are still many Fungus diseases for which we have not yet found a remedy; but considering the success in the past, we may look forward with hope to the future.

The testing of the best varieties of wheat, oats, and barley, but especially wheat for rust resistance, has afforded valuable results. This work should be further extended, more especially in the planting of plots in every locality as object lessons to farmers. Experiments to discover these varieties are always necessary, and publication of results useful, but the practical demonstration is what brings convincing proofs.

Horticultural School.

At the Horticultural School instruction is given to both male and female students. It is desirable that some means should be found of increasing the number of male students, as there is a demand for thoroughly trained horticulturists, who would be of service to the State.

The work of improving the gardens at Burnley is progressing satisfactorily, although much yet requires to be done before the plans of the Principal are carried into effect. Arrangements have been made for the establishment of several small model orch rds in various parts of the State under the supervision of the Principal. To do any good these orchards should be frequently visited and well managed, which will mean a severe tax on the time of the Principal, when we consider that he is intrusted with the direction of a school, the management of Burnley Horticultural Gardens, and expected to give lectures to horticulturists in various parts of the State.

Spaying.

The work of the spaying expert, Mr. Wilson, is one of the most practical and useful undertakings of the Department. In a country where paddocks are large and fences not in thorough repair, the culling

of breeding stock becomes a difficult and troublesome matter. The small percentage of losses amongst cattle spayed, viz., less than 1 per cent., is highly satisfactory, considering that this includes the additional risk incurred by 315 pupils taking lessons. I look to spaying as one of the best means available of raising the standard of the cattle in the State, especially in dairying herds, as through this medium unsuitable animals can be got rid of profitably. That there should have been no mishaps in castrating colts is highly satisfactory, as the method employed is infinitely superior to the old custom of searing. The number of poultry caponized is very few, considering the value of the operation as an aid to fattening and prime quality. Poultry breeders cannot, as yet, have thoroughly realized the advantages to be gained, or the numbers would have been greater.

The Export Trade.

The management of the export butter trade, and the inspection of dairies and factories by the staff under Mr. Crowe's control, has been highly satisfactory. The decreased quantity of butter exported is to be accounted for, in the first place, by the welcome increased consumption in Victoria, and secondly, by the decreased yield on account of the dry and unfavorable season, which reduced the total output. Efforts will, however, be made by the Department to show how a diminished yield can be prevented by the growth of forage crops, and, if money is available, by the establishment of a model dairy farm. Farmers are alive to the necessity of providing for their cattle, so that any effort made at the present time by the Department will be doubly effective.

The successful introduction of the milking machine has greatly lightened family labour, besides making it possible for farmers with small families to keep dairies.

The improved quality of Victorian butter as a whole is a matter on which the country and the Department may be congratulated. The increased value of exported butter, viz., £18,000 on account of improved quality alone, is a matter of which all connected with the dairy branch may well be proud. The practical way in which the inspectors were utilized, accounts in a great measure for the improvement in quality in such a short time. Every Monday they started for the dairies where the worst butter had come from during the previous week, and armed with reports as to faults, and tables showing how low the quality of the butter of each factory stood, in comparison with the butter of other factories, brought the truth home to the factory managers and boards of directors alike, making them willing listeners, eager for instruction, and ready to make an effort. This double inspection and instruction should be extended. I look to the instruction given at the University to dairy managers as a means by which lasting good will be done to the butter industry. Every dairy manager, however proficient, should attend this course.

The appointment of Dr. Cherry is a recognition of the necessity of scientific training in a dairy instructor which is heartily welcome, and an example to be followed in all appointments in every branch of the Department.

The hard and earnest work done by Mr. Potts, as a pioneer in scientific dairying, is highly appreciated, and should never be forgotten, however successful his successors may be. You can never do much good until you have stirred the enthusiasm of those you wish to instruct—and this is what he did. He laid the foundation of success, and every advance in Victorian dairying will still be largely due to his determined efforts.

The export of poultry and eggs is progressing satisfactorily under the supervision of Mr. Hart. This industry is yet in its infancy, and therefore requires to be carefully managed. At present the whole trade is done from the Government Cool Stores, so that it has been possible to select only such birds for export as were likely to aid in making a high reputation for Victorian poultry. The number of rejects, viz., 40,000, as against 200,000 exported, shows how thoroughly the work was done. The value of the poultry exported was £30,000, but this does not represent the total gain to producers, as a much higher price was maintained all round for poultry sold in Melbourne than could have been possible had the Government not provided facilities for export. Satisfactory returns have been received for eggs exported to London. The development of this trade will do much to steady prices here, insuring a fair return to producers at all seasons.

The inspection of hay, oats, flour, and potatoes exported, principally to South Africa, has been satisfactorily superintended by Mr. Knight. This is a position which requires good judgment, rectitude, and firmness of character, and the Department was fortunate in the possession of a man with the necessary qualifications.

The war contracts have furnished Victoria with a considerable amount of ready cash, which must have greatly relieved the strain that would otherwise have fallen on the farming community during the last dry season.

It is satisfactory to note the increased quantities of foodstuffs that have been exported from the State during 1901, compared with those of 1900; in fact, in beef and jam only has there been any decrease, while the export of poultry, veal, and pork, show marked increases. The export of pork is a new industry that may yet greatly develop, seeing that 1,380 carcasses were shipped in 1901, as against seventeen carcasses shipped in 1900.

The lean condition of lambs, on account of drought, caused considerable loss to shippers, who are likely to be more cautious in another season as to the quality of those they buy for export. The lack of slaughtering accommodation in Melbourne necessitated lambs being kept too long without being properly provided with food, which lowered quality still further.

Dr. Brown has had a difficult task to perform in preventing lean lambs being shipped to England, which he was unable to condemn as being unfit for human consumption. Armed with no other power than moral suasion, he managed to divert many of the poorer carcasses to other markets.

S. WILLIAMSON WALLACE.

August, 1902.

REPORT OF THE CHEMIST FOR AGRICULTURE, LANDS, AND WATER SUPPLY.

F. J. Howell, Ph.D.

The most important of the many changes which have taken place during the last twelve months in the life of this Branch has been the resignation of its founder, Mr. Pearson, who has been called to fill a more important position in another part of the world. The untiring industry and lofty ideals of the late Chemist for Agriculture have further raised the status of what naturally must be regarded as the most important office in the Department. The foundation science in agriculture—chemistry—must long retain a dominant influence in the working out of all progressive movements in that industry, and it is with some feeling of pride that I have been allowed to take up a position so full of great possibilities. The greatness of these possibilities has always been recognised by the late chief of this division. A study of the many reports and the many suggestions which have emanated from this office during the last fifteen years will reveal how clear the conception always has been of what the chemist might do for agriculture. But practical proposals seem to have been accepted as foolish theories, and it is only within quite recent years that the teachings of this Branch have made much headway against ignorance and prejudice.

The Operations of this Office.

The operations of the Chemist for Lands, Agriculture, and Water Supply embrace a wide field. The analysis when required of the soils owned by the State, with suggestions for their improvement, utilization, and adaptabilities for special purposes, may be supposed to lie within the functions of the Chemist for Lands. The duties of the Chemist for Agriculture may, among other things, be supposed to include the chemical and mechanical analysis of all land, whether of private or State ownership, with a view to the discovery of suitable methods of treatment both cultural and manurial, for the production of the various agricultural crops, and with the ultimate aim of a systematic classification. They should include the chemical analysis of all agricultural products, animal and vegetable, as also field tests with manures, systems of tillage, and experiments on the growth and improvement of crops, the production and after treatment of which may be supposed to require special chemical knowledge and skill.

The periodical analysis and bacterial examination of all country domestic water supplies, with a view to the detection of the presence of disease germs, and the maintenance of a proper standard of purity, together with the analysis of irrigation and stock waters, may be supposed to form the proper field of investigation for the Chemist of Water Supply. The duties of this office, then, are wide and all-embracing, and it is pleasing to see that a greater recognition is now being made of the usefulness of the work carried out by the Branch, and that a greater readiness seems perceptible to make larger provision for its necessary and legitimate expansion.

Proposals of the Office.

Repeated suggestions have been made by the office on the advisability of carrying out a complete chemical soil survey of the State, and the production of a soil map, not in a manner to prove of academic interest only, but to offer facts of practical value. That is, that it should be carried out in conjunction wich the growth of staple crops, which would enable us to have for the interpretation of results not only the figures of the analyst, but the answer of the growing plant itself. Such a work, it need not be mentioned, is one that could not be dissociated from that of an agricultural laboratory. Attention has also been frequently called to the necessity of a systematic examination of all agricultural products, animal and vegetable, and the importance has been frequently urged of giving such assistance as would allow of other lines of investigations being taken up that might be supposed to result in benefit to agricultural interests. The staff of the office has been quite inadequate for carrying such ideas into action, and the work of the Branch, as far as the analytical side is concerned, has been confined too much to the routine operations of an ordinary laboratory. The analysis of soils sent in indiscriminately and without, in many cases, sufficient guarantees of having been taken properly has occupied a lot of valuable time, and it seems difficult to convince the farmer that soil analysis, except under certain conditions, has not the exaggerated value which he attaches to it. In the investigations of the field, however, the Branch has struck out with great vigour and remarkable success, and if suggestions for further developments in this direction receive the support and sanction of the Government there is every reason to believe that a new crop of facts of still greater importance to the farmer might become available. The facts resulting from the experiments of this Branch so far have been obtained by working in co-operation with the farmer. There is no reason why that system should not for the purpose of answering certain questions continue; but there are problems of a more complex nature than any yet attempted, requiring for their solution long periods of time, constant observation, and much trouble, and for the answer to such questions we must go to the permanent experimental farm or station. The necessity for the establishment of such farms has been urged for years by this Branch; as bearing upon their value and the value of field work generally, the following papers have been furnished within the last twelve months, partly by the late Chemist for Agriculture, and partly by myself:—

Report showing advisableness of establishing experimental farms in Kerang, Longerenong, Goulburn Valley, Dookie, and Western District	18th July, 1901.
Further Report on proposed Experiment Stations in Victoria	2nd September, 1901.
The Field Work of Experiment Stations	2nd September, 1901.
Report on the Value to the Farmer of the Lecture and Demonstration Field	4th October, 1901.
Report on result of Inspection of available sites in the Goulburn Valley suitable for Irrigation Experimental Farms	16th January, 1902.
Report on the Leongatha Labour Colony as the site for an Experimental Farm	2nd May, 1902.

In addition to this I published during the year a small pamphlet entitled *How America Educates the Farmer.* It was written with a view of creating an interest in the scientific aspects of agricultural practice, and Mr. Pearson kindly shared with me the cost of private publication for free distribution.

Country Water Supplies.

In the report of the Chemist for Water Supply, dated the 3rd of July, 1899, it is stated :—"As to the analysis of waters for sanitary purposes, this work, which is obviously of very high importance, has received my special attention, and I was the first to introduce into Australia the method of chemical and biological survey of water supply systems by means of geographical inspection and the systematic gathering of samples. The old method of the perfunctory chemical analysis alone of odd samples sent in now and again was comparatively worthless." In the report of the "River Gaugings" of 1895 and 1900 will be found reports by the Chemist for Victorian Water Supply on much of the work carried out by this Branch, both on irrigation and sanitary waters.

It has long been urged by the Chemist of this Branch that consideration of the health of the residents of our larger inland towns make it advisable that some attention should be given to the purification of drinking waters, and a report dated the 11th August, 1898 "On a Proposed System of House Filtration under Central Management," contained some suggestions which deserved consideration.

The Year's Work on Water Analysis.

The great growth of the work in this direction is evident from a comparison of the number of analyses carried out for the year under review and the year preceding.

Samples 1901-2.	Previous Year.
178	43

All the supplies of the larger country towns have been periodically examined, both chemically and bacterially, and reports in each instance furnished to the Water Supply Department. The periodical examinations have not been made as frequently as they ought to have been, and representations were made by me to the Department at an early date, of the necessity of furnishing me with the additional assistance required to give the matter the close attention it deserves. Where the health of the community might be seriously endangered, no false notions of economy should be allowed to prevent important work receiving every encouragement. The appointment of the four additional students in my laboratory will, I hope, allow of greater attention to the matter.

The Work of the Laboratory for the Year.

The analytical work in all directions has increased very much. The growing use of artificial manures throughout the country has more than doubled the work in this line, while the desire for information on the part of farmers, for knowledge as to the deficiencies of soils, and the manures to apply, has also added to the number of samples

sent in. The tables show the number of samples of manures and soils received during two years.

	1901-2.	Previous Year.
Manures	236	115
Soils	132	104

The expansion of work in other branches of the Department has naturally led to a proportionate increase in work in this office, and developments in this line must continue. The appointment of dairy supervisors has apparently resulted in a more efficient supervision of dairy water supplies, utensils, and products, and the head of the Dairy Branch has increased the samples sent in for investigation in certain lines. An exhaustive examination of dairy waters, &c., &c., in co-operation with the Head of the Dairy Branch referred to in a later portion of this report is contemplated by this Branch.

The Chief Inspector of the Stock Department, conjecturing that the frequent deaths of stock might be in a measure attributable to the innutritious nature of the pasture, caused by soil deficiencies, has also co-operated with this Branch during the year under review in carrying out investigations on the mysterious deaths of cattle in certain portions of the State. These necessitated a number of analytical operations, the reports on which have been sent to the Department concerned.

The following is a list of the samples received for analysis during the year under review up to the end of May:—

Soils and Subsoils	132	Cheese	2
Manures	236	Dairy Salt	3
Minerals and Limestones	4	*Preservatives*	4
Diatomaceous Earths	5	Beeswax	1
Waters	178	Blood (Diseased Cattle)	2
Fodders	7	Fireclay	1
Beetroot	61	Barks	1
Wheats	6	Weeds	20
Tobacco Stems	1	Starches	1
Tinned Meats	64	Waterproof Cloth (Police)	3
Oils	1	Deposits	5
Butters	54	Miscellaneous	8
Milks	9		
Jams, Fruit, and Pulp	3	Total	816
Fruits	4		

This does not include Beetroot analyses carried out by Laboratory Analysts at Maffra. These number approximately 1,000 up to the end of May.

Field Work.

The field work of the Branch has been carried on with great vigour and most satisfactory results. The lectures that have b en delivered have excited warm interest among farmers, and applications are being received from all sides for the assistance of the Department in carrying out experiments in the manuring of various crops, and the growth of grasses and fodder crops. The soil requirements of our Northern wheat growing areas have been widely tested. The effect of small applications of phosphatic manures in so materially increasing the yield has aroused widespread interest, and there is little doubt but that the use of the drill and fertilizer will produce a revolution in the farming methods of the Northern districts. Most of the results on wheat manuring have already appeared in the pages of this *Journal*. The following Tables give the general average for the whole of the North :—

RESULTS OF EXPERIMENTAL PLOTS ("A" SETS) IN THE NORTHERN WHEAT DISTRICTS, 1901–2.

AVERAGES FOR 94 FIELDS.

Number of Plot	1	2	3	4	5	6	7	8	9	10	11	12
Manure given per acre ..	11 lbs. Concentrated Super-phosphate	No Manure	22 lbs. Concentrated Super-phosphate	33 lbs. Concentrated Super-phosphate	No Manure	51 lbs. good ordinary Super-phosphate	54 lbs. Thomas Phosphate	No Manure	46 lbs. Bone-dust	51 lbs. good ordinary Super-phosphate and 48 lbs. Sulphate of Ammonia	No Manure	51 lbs. good ordinary Super-phosphate and 87½ lbs. dried blood
	YIELDS IN BUSHELS.											
Cost of Manure per acre in 1901	1/4	..	2/8	4/-	..	2/2	2/2	..	2/0½	7/11½	..	7/0½
Lillimur to Nhill	12·17	7·97	14·28	15·58	7·93	14·21	11·86	8·05	9·24	14·18	8·06	14·33
(Average of eighteen fields) ..	4·20	..	6·31	7·65	..	6·28	3·81	..	1·17	6·12	..	6·27
Jeparit to Dimboola	11·58	8·08	14·95	15·87	7·87	13·03	11·87	8·37	9·41	14·17	7·82	13·31
(Average of four fields) ..	3·45	..	6·87	8·00	..	5·16	3·49	..	1·04	6·34	..	5·48
Horsham	15·29	10·68	16·68	18·29	12·12	18·43	16·19	13·04	14·19	16·84	12·04	17·08
(Average of four fields) ..	4·61	..	6·00	6·17	..	6·31	3·15	..	1·15	4·80	..	5·04
Warracknabeal to Murtoa ..	12·94	9·54	14·43	15·70	9·58	14·97	12·53	10·29	10·66	15·60	10·18	16·15
(Average of twelve fields) ..	3·40	..	4·89	6·11	..	5·39	2·24	..	·37	5·42	..	5·97
Boort to Charlton	8·35	6·84	9·13	9·22	5·93	9·00	7·96	6·68	6·79	9·33	6·39	9·43
(Average of eleven fields ..	1·51	..	2·29	3·29	..	3·07	1·28	..	·11	2·94	..	3·04
Birchip to St. Arnaud ..	14·52	10·72	16·36	17·74	11·02	16·22	14·01	10·80	11·70	15·92	10·36	16·01
(Average of ten fields) ..	3·80	..	5·64	6·72	..	5·20	3·21	..	·90	5·56	..	5·65
Stawell to Ararat	16·16	12·33	19·49	20·66	13·58	20·91	18·58	13·16	15·50	19·50	12·41	20·74
(Average of two fields) ..	3·83	..	7·16	7·08	..	7·33	5·42	..	2·34	7·09	..	8·33
Bendigo to Maryborough ..	17·14	13·63	18·81	19·43	12·66	17·37	16·74	12·07	14·86	16·69	12·76	18·91
(Average of seven fields) ..	3·51	..	5·18	6·77	..	4·71	4·66	..	2·79	3·92	..	6·14
Tatura to Shepparton ..	16·33	13·63	17·62	17·95	12·68	17·87	16·63	13·22	14·45	17·85	12·38	19·66
(Average of ten fields) ..	2·70	..	3·99	5·27	..	5·19	3·41	..	1·23	5·47	..	7·28
Cobram to Nathalia	10·82	10·46	12·49	13·68	11·10	13·04	12·40	11·39	11·25	12·30	10·44	12·70
(Average of five fields) ..	·36	..	2·03	2·57	..	1·94	1·01	..	·14 loss	1·86	..	2·26
Yarrawonga to Rutherglen ..	16·24	13·16	18·57	18·69	13·24	17·85	18·10	13·49	15·52	18·60	12·08	18·13
(Average of six fields) ..	3·08	..	5·41	5·45	..	4·61	4·61	..	2·03	6·52	..	6·05
Elmore to Echuca	11·49	8·14	13·57	15·04	7·81	12·89	11·98	8·09	9·64	13·29	8·46	14·12
(Average of five fields) ..	3·35	..	5·43	7·23	..	5·08	3·80	..	1·55	4·83	..	5·66
Average of 94 fields	13·58	10·43	15·53	16·49	10·46	15·48	14·07	10·72	11·93	15·35	10·28	15·88
	3·15	..	5·10	6·03	..	5·02	3·35	..	1·21	5·07	..	5·60

The first line of figures gives the actual yields in bushels, the second line the increases *due* to manures.

The discussion of these results will be delayed for a more appropriate time. The returns are of a highly satisfactory nature, and clearly reveal the fact that the use of phosphatic manures, even in the most unfavorable of seasons, may result in marked increases in yield in the Northern wheat crops. The cost of the manures, taking Melbourne prices, that have produced these increases, is, comparatively speaking, a trifling one. It runs as follows for the different plots per acre :—

Plot 1.	Plot 3.	Plot 4.	Plot 6.	Plot 7.
1s. 4d.	2s. 8d.	4s.	2s. 2d.	2s. 2d.

Putting the price of wheat at 3s. 3d. per bushel, the resulting profits would be—

Plot 1.	Plot 3.	Plot 4.	Plot 6.	Plot 7.
8s. 11d.	13s. 9½d.	15s. 6d.	14s. 2½d.	8s. 7d.

It will be observed on comparing the returns of Plots 6 and 10 on the Tables referred to that the addition of nitrogen has resulted in no material gain. On Plot 12, nitrogen in the form of dried blood might be thought to have produced an increase of approximately half-a-bushel; the gain, however, is not sufficiently marked to indicate a deficiency of that ingredient deserving consideration, as the greater *part of the increase might be attributed to the small amount of* phosphoric acid contained in the blood.

Other Crops and other Districts.

Extensive experiments were also carried out in the manuring of hay, root, fodder, and various other crops ; but many of the farmers have not taken the trouble of separately harvesting and weighing the plots and sending in returns. A small percentage of the interesting facts that might have been available with a little extra trouble is therefore *only to hand. The following are among the more interesting of the* returns which have been received by this office :—

Results of Potato Manure Experiments on the Farm of Mr. E. Morton, Oatlands, Drouin.

Manure given per Acre.	Yield per Acre.	Gain due to Manuring.
	lbs. of potatoes.	lbs. of potatoes.
1¾ cwt. nitrate of soda ... ... 1 cwt concentrated superphosphate ... 3 cwt. gypsum	16,380	9,300

The above dressing, it will be seen, resulted in an increase of over four tons of potatoes to the acre in a very unfavorable season. The above results are the returns from one plot only. There were eighteen plots in the experimental field of this farm, each treated differently as regards the quantity and the kind of manure. The results in detail will be given at an appropriate time.

Experiments in the Manuring of Hay Crops.

Some striking results have been obtained in this direction on some of the soils of the Western District. The climatic conditions of that part of Victoria are so different from those of the Northern areas that the manure applications require to be very much heavier; the greater diversities of soil render the question also a more complicated one. The following returns from the farm of Mr. Bremner, of Allansford, are very striking:—

Manure given per Acre.	Yield of Hay per Acre.	Gain due to Manuring.
	lbs.	lbs.
2 cwt. sulphate of ammonia ... 2 cwt. ordinary superphosphate ... ¾ cwt. potash chloride ...	6,040	4,360
3 cwt. sulphate of ammonia ... 3 cwt. ordinary superphosphate ... 1 cwt. potash chloride ...	6,920	5,500

Fruit Manuring.

In no direction has this Branch put forward stronger efforts in arousing an interest in the question of manuring than among the fruit-growers of our State. As Instructor in Agriculture, I lectured before the greater number of the Horticultural Societies of the State, and, as an outcome of these lectures, the use of manures has extended considerably in the orchard. This applies perhaps specially to the fruit-growers of the Goulburn Valley. It is in the experimental work, however, that the fruit-grower has failed us. The harvesting of the plots comes at a particularly busy time, and involves some trouble. The result is that returns are not available in the number they ought to be. Until the fruit-grower realizes that field experiment affords the only reliable source of information on the subject, the most important answers in connexion with fruit manuring can never be given. Among the most interesting returns to hand this year are those of the Gallagher Bros., of Lancaster. I give the returns and increased yields on one plot only. The trees manured were peaches.

Manure given per Acre.	Yield per Acre.	Gain due to Manuring.
	lbs.	lbs.
128 lbs. concentrated superphosphate 256 lbs. potash chloride ...	10,073	5,112

In this case the application of a phosphatic and potash manure more than doubled the yield of the peach crop.

Fodder Crops.

Like the crop just dealt with, there is difficulty in getting returns from experiments in the growth and manuring of fodder crops. The farmer wishes in most cases to feed them gradually to stock, and shows a disinclination to allow the field to stand, and be harvested at the one time. The splendid returns from an experiment in rape manuring on the farm of Mr. Greenham, of Dartmoor, will, I feel confident, arouse

widespread interest. The full field was not harvested and weighed, but equal portions from a representative part of each plot were cut and weighed, and the weight of the whole plot calculated from this.

The following are the results obtained on two of the plots in this experiment :—

Manure used per Acre.	Yield per Acre.	Gain due to Manuring.
	lbs.	lbs.
2 cwt. ordinary superphosphate ... ¾ cwt. potash chloride	59,060	54,540
2 cwt. ordinary superphosphate ...	53,796	49,276
Adjoining check plot, without manure	4,520	—

It will be seen from these figures that the use of 2 cwt. of ordinary superphosphate per acre resulted in an increase of 22 tons.

I have attempted everywhere, till now with scant success, to get the farmers of Victoria to take up this crop as an experiment. For our drier areas, as much as the better favoured portions of our State, there is, in my opinion, no crop which gives greater promise of proving a success In the Wimmera—during seasons of a fairly early rainfall—splendid crops have already been obtained, but the idea seems general that it is only during occasional years that this can be relied upon. The crop, however, has always been grown without a fertilizer, and I am inclined to think that, drilled in with 75 lbs. of an ordinary superphosphate, rape might be put in in the northern portions of our State a month, and even perhaps six weeks, later than the period at present regarded as the outside limit for successful growth.

The Manuring of Hops.

The hop is a crop deserving some attention at the present moment. The industry of hop-growing is a languishing one, and all efforts that might help to render it a more profitable one deserve the co-operative assistance of the farmer. We have not as yet succeeded in rousing much interest among the hop-growers in the field experiments of the Branch, but fresh attempts will be made this year to induce growers to have manure tests made on the crop, with a view to both increase of yield and improvement in quality. There were two tests only carried out last year. One was a failure, owing to the saltness of the water used in irrigating. The second was made on a somewhat irregular piece of ground, but the results indicate clearly that there is a promising field for successful experiment in this direction. The following are the returns from two of the plots on the experimental field of Mr. G. Whelan, of Swan Reach :—

—	Yield of Hops per Acre.	Gain due to Manuring.
	bushels.	bushels.
6 cwt. sulphate of ammonia ... ... 3 cwt. concentrated superphosphate ... ½ cwt. potash chloride	440	180
3 cwt. sulphate of ammonia ... ... 460 lbs. bonedust ... ... 1 cwt. potash chloride	720	180

Experiments for the Better Utilization of Waste Lands.

Funds for a wide and varied system of experimenting by this Branch on the waste and poorer lands of the State should be provided freely by the Treasury. I have every reason to believe that expenditure in this direction would prove of a highly reproductive nature. There are wide areas of land in Victoria of little present productivity, and regarded as worthless from an agricultural point of view, which might, I think, by a comparatively-speaking small expenditure in fertilizers and judicious treatment in other directions, be converted into lands of a fair agricultural value. Reasons of economy might give the pretext for a contraction in experimental field work as it will do in other directions. Such a policy would be a suicidal one for the development of our agricultural resources, and I would urge that no hindrances be placed on the forward movement this Branch has already succeeded in making. The results already obtained have justified by more than one hundred times the small expenditure incurred. Without any spirit of boast it is a performance to create some feeling of pride that this Branch has succeeded within the short space of two years in solving the soil problem chemically considered of nearly the whole wheat-growing area of the northern portion of Victoria. The great mass of facts already to hand allows us to speak in full confidence of the universal soil deficiency of that area—the manure most effectively and cheaply supplying it—the approximate quantity, taking one year with another, giving the best results—and the increased yield and probable profits the farmer can rely upon for his expenditure. The problem of the southern portions of the State already under cultivation appears a more complicated one, and is still awaiting solution. The problem of the utilization of soils, both in the northern and southern portions of the State, considered up till the present moment too poor for agricultural purposes, is only just beginning to excite attention. Experiments have already been commenced in the large stretch of sandy country in the north-west known as the Little Desert. The results so far give encouragement for further efforts. Preparations have also been made at Foster, in Southern Gippsland, for conducting experiments in the area known as the Heath Country. A cheap system of under-drainage has already been carried out on the experimental field, and the land broken up. The manures are to be applied shortly, and grasses and crops will be put in in the early spring.

Experiments in Beet Growing.

Interest in the sugar-beet industry has, I fear, fallen to a very low level; but it is precisely at such a period of general apathy that the duty of the chemist in combating this becomes more pronounced. It is still the work of this Branch—justified by figures already available—to accumulate new facts, and not to suggest that lines of investigation on the soils and climate best adapted to the crop, on periods of sowing and harvesting, methods of cultivation and manuring and other matters, should be given up because the great possibilities of the industry have for the moment been obscured. The desire of this Branch is still to do

so—in face of all the criticism that has been given and will be given on the future prospects of the industry. The power of the Branch, however, in carrying out this desire will be controlled by the support or otherwise that the Government may give it. A great deal of analytical and field work has been carried out in connexion with the beet, the results of which will be given at a later period. There were over 50 fields put down in the Maffra, Glengarry, Cowwarr, Flynn's Creek, Traralgon, and Geelong districts. The weight of the crops and the sugar percentage have been determined in all cases.

An Extension of the Work of the Branch.

The taking over of the control of the Edi Tobacco Farm and work in connexion with the contemplated experimental farms will considerably widen the field of investigation in both field and laboratory. In the study of the tobacco soils of the State after the American method, we shall have the first attempt made of treating the question of tobacco production in a truly scientific manner. The great influence of the texture of soils upon the type and quality of tobacco grown has been beautifully brought out in the classical investigations of Professor Witney. Preparations for the mechanical analysis of our tobacco soils and the periodical determinations of the moisture contents are now being made in this laboratory. Field tests with different seed varieties (to the extent we have them) will be carried out on the various soils, manure experiments conducted, the treatment of the plant at various stages varied, and a number of other operations carried out which we think might eventuate in results of practical value. For comparative purposes with American analyses, the methods of soil examination in this laboratory will be those employed by Professor Witney in his investigations. This will necessitate a large use of the microscope for the measurement of soil grains. The valuable services of my assistant, Mr. Price, will be available for these investigations.

Improvements in the method of curing the tobacco can not be suggested or investigated this season. The leaf has already been in the sheds for some considerable time. It is a question whether such investigations might not be more appropriately placed in the hands of the Vegetable Physiologist. It is a debatable question whether it would be possible without large expenditure in the construction of a number of sheds, and a large quantity of leaf that would have to run the risk of spoiling, to carry out such investigations, and it might by preference be advisable to secure the services of a thoroughly competent man with experience in the very latest modifications to instruct in these matters. These are questions for the answering of which I shall require time and consideration.

The work in the Laboratory affected by the increase of work in the field.

I have dwelt specially up to this point on the activity of this branch in the field, but the operations in the field are intimately mixed up with the operations of the laboratory and an increase of work in the one direction involves a corresponding increase in the other. In no direction

has the development of field operations reacted more on the work of the Branch than in the clerical division. The total outward papers, mostly typewritten, number for the year to date 5,307. In the case of each experimental field, plans and particulars for laying out the ground, a detailed statement of manures used, and calculated results obtained showing actual yields, and increases due to manures, are sent to each farmer with suggestions based on the result of the experiment. In addition to this district reports, treating of groups of fields are furnished to the Agricultural Societies concerned—and finally a general report summarizing the results of an entire area is drawn up and distributed generally. The calculations involved in such work are enormous when carried on in the wholesale manner attempted by this Branch. There is frequently an angry impatience on the part of the farmer for immediate information as to his results, and there was no additional assistance more absolutely necessary in this office to prevent complaints than the clerical I have recently obtained. I have to specially thank Mr. Hatton for the long hours of overtime he has given each day to enable me to get out the returns in proper time.

The work of the Manure Mixing Room.

This is work also of an arduous nature requiring great accuracy and care. All the manures for the various plots are separately weighed, bagged, and numbered. In cases where a complete manure is used the contents of each bag may involve four separate weighings. There were 5,060 such bags sent out to the various farms for the twelve months up to date. In addition to this stout pegs bearing numbers corresponding to those on the various bags of each field are also sent with each manure set for the purpose of marking out the fields. The manures used in the experiments are frequently analyzed to see they conform to a common standard. The supervision of this work was placed in the hands of Mr. Kosky.

Suggested developments for the coming Year.

The developments in the extension of work in this office may be clerical, in the further widening of field tests, and in laboratory investigations. The extra clerical assistance which was asked for a twelvemonth ago, and has just recently been sanctioned, will obviate the delays in getting out the results of experiments, and allow of earlier information being given to the thousands of questions that are yearly received from farmers. It will allow of the indexing and registration of the correspondence of the last fifteen years, and it will, I hope, enable me to make some classification of the thousands of soils which have been analyzed in this laboratory. In the registration of correspondence and the classification of the soil analyses alone there is, I fear, a good solid year's work.

Developments in Field Work.

The most important manurial questions as far as the production of cereals in the northern area is concerned have already been answered. Further information in this area on minor points can only be obtained

by the experimental field of a more permanent kind. A few such fields have already been established, but there is no guarantee that the interest of the farmer will be sustained sufficiently long to achieve the purpose aimed at. We can only hope that this will be so. It is the western and southern areas of the State that I now look to principally for future developments. With a climate admitting of a wide variety of crops and soils showing apparently greater diversities than our more arid areas, there are in this portion of our State soil problems of far greater complexity to be worked out than under the more uniform conditions of the north. Next season I hope to test in the northern areas certain crops which I think might enter into simple systems of rotation. Indiscriminate tests have at times been made by the farmer, ending in most cases in either failure or only partial success. Unsuitability of climate has invariably been assigned as the cause for this, There are indications that soil deficiencies more than climatic peculiarities may have been the responsible cause. The question opens up a line of investigation strictly within the province of the chemist. Application has been made from this office for the temporary services of a competent officer to make a systematic collection of the seeds of our native grasses, especially those of drought resisting qualities. This is a matter that should not be delayed too long. It is important that this Branch should be allowed to test these grasses under cultivation and with manurial treatment.

Developments in the Laboratory.

The great possibilities for the chemist in the investigations of the field have by no means obscured the wide scope for his activities in the laboratory. There are lines of work just as pressing and equally as important in the last direction as in the first. I have already called attention to this. In a letter to the Director, written primarily for the purpose of calling attention to the inadequacy of the staff to cope with even the current work of the three departments carried out in this office, I used the following language: "The matter of four additional students has, I thank you, received your early attention and support, and I would respectfully ask that the necessary formalities be gone through as early as possible to enable me to appoint. The work in the laboratory is, as you know from your personal inquiries, congested and the staff undermanned. Most important laboratory work has had to be neglected for the want of hands to carry it out. It is, for instance, essential for the extension of our export trade that our vegetable and animal agricultural products should be systematicall, analyzed. I would ask you to convey to the honorable the Minister the fact that, with the view of gaining some information on the quality of what we export, it is my intention as soon as I can secure and train the additional students, to commence systematic work on the following lines:—

(1) The chemical and microscopic examination of the various jams and pulps on the market, testing for adulteration, the sweetening with glucose, the presence of preservatives, as also the quality of the material used for canning and soldering.

(2) A systematic examination of all canned meats.

(3) A chemical and microscopic examination of all waters used for dairy purposes.

(4) A chemical examination of all butters, more especially with the view of testing for the presence of undesirable preservatives.

(5) A chemical examination of Victorian cheese, and the comparison of the results with imported brands, &c.

Investigations demanding immediate attention would of course be taken up first, but such investigations might finally include an examination of all exportable agricultural products, both animal and vegetable.

Applications have long been made for the erection of a small wheat testing mill in this laboratory. When this request has been sanctioned investigations in the qualities or deficiencies of our flour can be carried out—a matter of great importance. Up till now we have simply considered manuring from the point of increased yield, neglecting the equally important consideration of improvement in quality. I have reason to believe that the application of phosphatic manures in our northern areas will not only result in increased yield, but also in improved quality.

The few facts only I have brought forward here will indicate the wide field of work of immediate practical value that might and ought to be taken up in an Agricultural Laboratory. The directing head of such an institution should be given all the assistance he requires for putting such ideas into execution. The members of the staff should be placed on a more secure footing, and receive a remuneration more in accordance with the qualifications they possess, and the work they carry out. It is, to say the least, most discouraging after a student has gone through a complete training—mastered the processes of agricultural analysis—and become of priceless value in carrying out special lines of work, to find him snapped up by some outside firm offering a salary three times that provided by the Department. I would urge upon the Department the advisableness of regarding such a man as a valuable asset to the State. An Agricultural Chemist is not the product of a day. If we are to keep pace with the rapid march of Agricultural investigations in other parts of the world, we must retain our trained men by paying them at least the wages of an ordinary mechanic. To pay young men in the prime of life a salary of £75 per annum, after six and seven years professional training, is certainly not to the interests of the Department—What it may be to the officers concerned is not for me to say.

A Bare Outline Only.

In the small space at my disposal I have only been able to imperfectly sketch the work carried out during the year just past, and to indicate the bare outlines only of what might be attempted in the future. There are many matters of very great importance of which no mention even has been made, as for instance the study and control of soil moisture in our arid areas, the examination of the physical

properties of our typical soils, and investigations into the controlling influence that differences in these might exert upon crop distribution and production. The importance of such matters, which are essentially agricultural problems, has not been overlooked. In the course of time I hope to see different lines of chemical investigation specialized in this laboratory. The young men at present engaged here are each day fitting themselves to take up such lines of work under the sub-leadership of my senior analysts. For the present the field I have sketched is sufficiently wide, and will, I hope, indicate that the responsibilities and duties of the office I have only recently been called to are as clearly defined to me as they were to the capable officer who laid its first foundations and made it what it is to day.

Concluding Remarks.

My closing remarks are for the staff that has worked loyally for me from the first day I took office. In the clerical, analytical, and field divisions, all have acted as if they were partners in a large enterprise of mutual interests. Investigational work of any kind attracts and fascinates—but in the problems of Agriculture there seems room for a warmth of enthusiasm and interest afforded by no other line of research. I feel sure the young men who have been attracted to this office will, with proper treatment, come under the influence of this feeling, as the seniors already have done, and that they will labour to fit themselves for the important positions which must soon offer if Agriculture is to advance—as its best friends wish it should do.

REPORT OF THE SCIENTIFIC DAIRY INSTRUCTOR.

H. W. Potts.

In reviewing the progress and work of the past year, I have to report a continuous interest in the educational training conducted by me in the dairying localities of the State. Farmers, factory managers, employés and others associated with the industry show by their attendance at, and the deep concern they evince in, the lectures and demonstrations that they fully and earnestly appreciate the facilities placed at their disposal by the Department of Agriculture.

The year's work was characterized by the direct attention given to the necessity for re-building and equipping a number of butter factories. These were originally built to provide for an output of considerable magnitude, but that estimate has been largely exceeded. Dairying has expanded beyond expectations, and many factories have outgrown their usefulness. The ever-apparent progress in methods and improvements in machinery and appliances have also rendered the original equipments old-fashioned and unsuited to the existent demands for quality and increased turnover. It has been part of my duty to point this out forcibly and clearly to shareholders, with a proper sense of responsibility, in several important districts. It is gratifying to note that, in the endeavour to reach and maintain a high standard of excellence, those interested in the butter factories as shareholders have indorsed this policy in a practical way, and provided their boards of directors with the requisite authority to re-build or alter the factories and afford suitable appliances in such a manner as to meet modern demands.

During the year some time was devoted to the duty of assisting Mr. J. L. Dow in the inspection of farms entered for competition for the splendid prizes given by the proprietor of the *Leader*, Mr. D. Syme, for the best dairy farms. This second tour of inspection has clearly demonstrated the stimulating influence and educational effect of these admirable competitions in relation to the augmented milk and butter yields, system of grazing, cultivation of pastures and fodders, the preservation of fodders throughout the year, the breeding and rearing of improved dairy stock, and general dairy management.

These farms are situated in every part of the State under the most varied conditions of soil, climate, and environment. It is a matter for congratulation that the success of the past competitions is sufficient to encourage the donor of the prizes to continue them.

In addition to the visits paid to these competing farms, opportunity was taken to visit farms in every centre where other duties took me. By a personal inspection, I was better enabled to afford assistance, and give advice in the breeding and selection of suitable stock, methods of feeding, dairy details, and sanitation. In all, 169 farms were visited. I should add that each visit was made as educational as possible, from a technical point of view; and I have to acknowledge the hearty welcome and attentive interest evinced by the farmers on whom it was my privilege to call.

Seventy-four public lectures, with lime-light illustrations, were given to producers on subjects of value, such as the breeding and feeding of dairy stock, dairy management, &c. There was an aggregate attendance of 6,993. The following places were visited :—

Tungamah,	Gobur,	Keilambete,
Stawell,	Merton,	Garvoc,
Willung,	Seymour,	Purnim,
Cobden,	Myrniong,	Panmure,
South Purrumbete,	Bacchus Marsh,	Kerang,
Scott's Creek,	St. Arnaud,	Koondrook,
Port Campbell,	Warragul,	Gannawarra,
Tooradin,	Cobrico,	Cohuna,
Geelong,	Ballarat,	Bealiba,
Leigh-road,	Toolern,	Donald,
Clydebank,	Melton,	Corack,
Nirranda,	Euroa,	Wycheproof,
Cowwarr,	Gormandale,	Echuca,
Heyfield,	Traralgon,	Bena,
Toongabbie,	Kongwak,	Leongatha,
Glengarry,	Korumburra,	Tatura,
Tinambra,	Sale,	Springdale,
Yea,	Bairnsdale,	Trafalgar,
Narracan,	Orbost,	Glenormiston,
Flowerdale,	Boisdale,	Murchison,
Strath Creek,	Maffra,	Shepparton,
Glenburn,	Milawa,	Castlemaine,
Murrindindi,	Framlingham,	Port Fairy,
Molesworth,	Terang,	Warrnambool,
Cathkin,	Broadford,	Farnham,
Alexandra-road,	Wangaratta,	Swan Hill,
Kanumbra,	Swanpool,	Tragowel,
Bonnie Doon,	Benalla,	Macorna,
Maindample,	Ballangeich,	Camperdown,
Nillahcootie,	Panmure South,	Lancefield.

The system of visiting butter and cheese factories to teach managers and others in small groups inaugurated last year has been followed up with pleasing results. Sixty-four butter factories, two cheese factories, and two bacon factories, with 31 creameries, were inspected, at which tuition was given.

Seventy-one lectures, with demonstrations, were arranged and given, with a total attendance of 352.

A distinct improvement is observable on all sides in the general adoption of improved methods in the factories and test-rooms. Manufacturers are paying a much more intelligent regard to these than formerly.

During the visits to factories, creameries, and farms, special care has been directed towards encouraging the adoption of better means of sanitation.

By request, I attended nineteen meetings of boards of directors, at which matters of obvious practical importance were discussed.

The special lessons on dairying subjects to children in the State schools in dairying centres have been continued, and are now recognised as part of the school curriculum. This work is being rapidly taken up by the teachers after a course of training at the Summer School, and with the assistance of the published lectures in the Department's *Journal*.

Fifteen agricultural societies' shows were attended, at which the milking contests were supervised, and the tests conducted.

One of the most significant introductions to dairy farmers since the establishment of our factory system is that of a suitable and effective milking machine. During the year a number of practical tests have been conducted, and, so far, all point to the fact that the recently introduced Kennedy-Lawrence milking machine will provide the dairy farmer with an appliance of considerable economic value, and relieve him of a strain under existing labour conditions which in the past has proved a disturbing element.

By direction of the Hon. J. Morrissey, late Minister of Agriculture, I undertook the task of editing the *Journal* of the Department of Agriculture, which necessarily involved the organization of a contributing staff from the expert branch of the Department. The success of the first and subsequent issues will be chiefly due to the efforts of my fellow officers in placing before our producers literary material of practical utility and interest.

My time has also been largely occupied as a member of the Royal Commission on Technical Education in attending 30 meetings and six inspections. The labours of this Commission have been brought to a conclusion.

I also attended fifteen meetings of the Leongatha Labour Colony Trust, and visited the farm on three occasions.

Considerable time was devoted to laboratory work. Examinations, with reports, were made on 97 samples of milk, 8 samples of cream, 76 samples of butter, 79 samples of water, and 18 samples of salt.

The clerical portion of my office labours included the writing of 1,200 letters and 149 reports, principally relating to our butter and cheese industries. During the year 13,620 miles were traversed by rail and road.

REVIEW OF THE PAST BUTTER SEASON.

By R. Crowe, Dairy Expert.

In many respects the past season has been a disappointing one, owing to circumstances over which, fortunately or unfortunately, we have had no control, excepting that those engaged in the industry might have made greater provision for their stock by feeding and shelter. Of course, the severe drought is accountable for much of the shortage in our butter exports, but the largely-increased export trade in hay and chaff, due notably to the South African War, has taken enormous quantities of fodder from our shores which, under ordinary conditions, would have been available for our own dairy stock. Therefore it would, perhaps, be hardly fair to blame dairymen for selling their hay excepting in so far as they wilfully caused their cows to be short of feed by so doing. The value of hay and fodder exported since the beginning of the year reaches a total of about £420,000, which sum approximates in value to the shortage in butter production for the season. It is purely a matter of pounds, shillings, and pence, and if considerably more profit could be obtained by allowing the cows to go dry earlier than usual, and realizing at once on the feed which would otherwise have been saved in order to prolong the period of lactation, it was only natural that this should be done. Unfortunately, however, some, in their eagerness for an immediate return, neglected to retain even sufficient to keep up the health and condition of the dairy stock through the season of scarcity. It might, perhaps, be pointed out with advantage that as the farmer does not exhaust the fertility of the soil so much by dairying as he does by sending away raw products such as hay and chaff, &c., it would be well for him to bear that in mind when tempted to realize immediately on these crops.

The rapid diminution of our timber during the last year or two has rendered artificial shelter of some kind or another essential on every dairy farm. The unreliability of labour offering has been one of the reasons why numbers of those who were dependent on such hired assistance have abandoned the business altogether. However, the milking machine, which this time last year was on its trial, has proved a continued success so far, and many dairymen in each district of the State are adopting it. Several other causes have operated to reduce our exports as compared with the previous two seasons, notable amongst them being the high price of fodder as above mentioned and the fattening of stock, which has lately become so much more remunerative. The financial circumstances of those formerly engaged in dairying are now such—to the credit of the industry be it said—that they are no longer required to work at such high pressure as in days gone by.

Quality of Butter.

It is satisfactory to be able to record a noticeable improvement in the quality of the butter manufactured and exported. For the season just closed, as shown in Table A, 84·9 per cent. of the butter exported

received 95 points and over out of a possible 100, as compared with 65·3 per cent. for the previous season; 15·39 per cent. scored between 90 and 95 points, against 27·35 per cent.; and ·45 per cent. between 85 and 90 points, as against ·654 per cent.; and ·06 per cent. last year

TABLE A.—Showing comparison of Quality of Butter exported for Seasons 1900-1 and 1901-2.

Points.	Percentage, 1900-1.	Percentage, 1901-2.	1900-1.	1901-2.
100	...	...		
99	1·07	·91		
98	18·01	37·06		
97	19·34	22·77	65·30	84·09
96	16·04	14·40		
95	10·84	8·95		
94	8·36	9·53		
93	6·21	3·70		
92	5·46	1·46	27·35	15·39
91	5·14	·45		
90	2·18	·25		
89	1·56	·18		
88	1·75	·24		
87	1·39	·03	6·54	·46
86	1·18	·01		
85	·66	...		
84	·37	·06		
83	·18	...		
82	·06	...	·81	·06
81	·11	...		
80	·07	...		
Pastry	·02	...		

against ·81 per cent. below 85 points. In other words, the butter of a quality below 85 points has been, as far as the export trade is concerned, improved almost out of existence. The same might be said regarding that ranging between 85 and 90 points, as less than half of one per cent. of the total was included in that grade last season, and even in the sounder qualities of butter there is a substantial improvement, for only a little more than half the percentage of the previous year secured between 90 and 95 points. I am much indebted to the faithful assistance of Mr. James Wilson in compiling those records. In order to enable the position to be more easily understood, let us suppose that 15,000 tons were exported each year; then 12,613½ tons was of a quality to secure 95 points and over, against 9,795 tons for the previous season; 2,308½ tons against 4,102½ tons between 90 and 95 points; 69 tons against 981 tons between 85 and 90 points; and 9 tons against 121½ tons between 80 and 85 points. I maintain that with a moderate effort all our butter can be brought up to 96 points. The work done in that direction alone during the last year has resulted in an increase of over £18,000 sterling in the value of our produce without taking into consideration the corresponding rise in the quality of butter sold locally. This means much better prices for the total butter exported, and an accession to our reputation as producers of a good article.

Causes of Improvement.—This satisfactory state of affairs has been brought about by the directing of more intelligent effort to the business on the part of the great majority of dairymen and factory managers; and the system of definitely recording the quality of all butter sent forward for export, advising where room for noticeable improvement exists, and sending out instructors when the faults cannot be remedied by correspondence alone, is now bearing good fruit.

The tables issued showing the quality of each factory's output have also fostered a spirit of emulation, as it has been recognised from the figures that a comprehensive measure was being applied to their efforts. An impression has got abroad that the three highest numbers belong to the factories which secured the Department's prizes for the export season 1900–1, but such is not quite true. Included amongst those numbers are factories which did not export for the full period specified in the conditions of the competition, and, therefore, they were debarred from receiving a prize. Within the last year, two dairy supervisors have been appointed by the Department of Agriculture to instruct factory managers and dairymen, and to bring about a uniform system of dairy inspection that must conduce towards raising the standard of our milk supply. Since their appointment both Messrs. Archer and Carroll have done excellent work. During the export season they were chiefly engaged in assisting managers to remove faults found in the butter sent forward for export. They attended every Monday morning at the Government Cool Stores, where they were provided with a list of localities whence the worst qualities of butter had been received during the previous week, and on Monday evening they both left by train with the special purpose in view of devoting the utmost attention to any dairying centres where distinct improvement was necessary. They instructed the factory managers as to any defects in their method of butter or cheese-making, and advised the directors of companies regarding the lighting, ventilation, drainage, and general sanitation of their buildings, and the efficiency or otherwise of their machinery. They have also investigated and set right various misunderstandings which arose from time to time between milk suppliers, directors, and managers of factories, thereby helping to create a better and more friendly feeling between the companies and the dairymen.

Many instances are recorded in the butter classification books of the Department where the output of factories was improved by the visit of the instructors to an extent equal to an advance in price of 3s. per cwt. A glance at the records regarding the output of localities visited always enables them to keep in touch with factories, and learn whether the results were permanently effective. It was recognised from the first that, next to improving the quality of butter from a manufacturing point of view, a much wider sphere of usefulness existed in educating the dairymen up to the production and supplying of a purer and better quality of milk, but owing to limitations of time and distance it will be seen that two men could not possibly visit every dairy farm in the State.

Dairy Inspection.—A very important part of the duty of the Inspectors was to learn what steps were being taken by municipalities towards the adoption of dairy supervision calculated to improve the source of supplies, and also to bring about uniformity in the methods of local Inspectors. Although their visits were at first received, as was only to be expected, in one or two instances with a certain amount of distrust, when the dairymen were made acquainted with the real nature and scope of their functions they, without exception, secured the confidence of all by giving valuable instruction, and those who were in the first place most distrustful, now have shown their appreciation by asking that the officers might again visit them, and by referring to the Department for advice, particularly in matters relating to the laying out of milking yards, piggeries, and farm-yards, and the erection of dairy buildings generally.

We have, therefore, now no hesitation in saying that we have in process of development the best system of dairy inspection in Australasia. The report of Mr. R. Caldwell, M.P., Chairman of the Dairy Board in South Australia, who had been commissioned to investigate the methods of inspection adopted by neighbouring States, furnishes a striking corroboration of this statement. His inquiry included not only our own State and New South Wales, but also New Zealand. He says in his recommendations to the Board that they "could not do better than follow the example of Victoria," and adds "that the Government of this State" [that is, Victoria] "has not gone quite so far by act or regulations in the control of the dairying industry as New Zealand, but there is no denying the fact that a most vigilant watch is being kept by the Department of Agriculture."

Instruction in Dairying.—From what I have said it will be seen that we have mastered the problems in the direction of improvement of the quality of our butter, and are rapidly travelling on the up grade. Our prices at the close of the season on the English market were near to and almost touched the same figures as those ruling for Danish butter, and, although the attention of dairymen has continuously been directed to the necessity for improvement in the breeding, feeding, and treatment of dairy stock, something in the nature of practical instruction is badly required. Steps are being taken to that end by the establishment of a dairy college, or, rather, a dairy experimental farm, where facilities will be provided for the higher education of every one connected with our great dairying industry. Unfortunately, attempts have been made to show that such an institution is not necessary, but I think those who are opposed to it misunderstand the motive of the Department. It is not intended to build an elaborate establishment with spires and cupolas or other embellishments. The accommodation to be provided for pupils is to be of the simplest and most inexpensive nature. The primary object is to conduct experiments in the growing of fodders, the treatment of dairy stock, the testing of dairy appliances and methods, the preparation and issue of pure cultures for cream ripening, &c., and the dissemination of the information afforded thereby for the guidance of dairymen all over the State. No reasonable person can take exception to a movement of this nature.

Where our Butter is produced.—By referring to Table B, showing the total arrivals of butter in Melbourne by rail from the various districts, it will be seen that most headway has been made in Gippsland. From 1899 the Gippsland district shows a gradual increase yearly, and the Western district a gradual decrease. The north-west, or Wimmera, is included in those returns, and is responsible for the largest share of the deficiency shown by the Western district figures. Both the North-Eastern and North-Western districts exhibit the same increase in 1900 over 1899, and a very considerable decrease in 1901 as compared with 1900, the total for last year being only about two-thirds of that for 1900. It is, therefore, to that portion of the State we have to look as being accountable for the greatest falling off in our export trade. North of the Dividing Range the climate is less reliable than in the southern districts, and assistance to maintain production is therefore more necessary in that quarter. It becomes increasingly incumbent upon the dairymen in this locality to study the growth of suitable fodder crops to prolong the period of milking. In certain areas irrigation is available, but so far little use has been made of the water, even where it is available, to produce fodder for the dairy cattle. Lucerne and sorghum have been found to grow luxuriantly where tried with the aid of i rigation in the summer months. The great drought of last season has caused numbers to take steps to at length utilize the water. This should materially increase the production of such localities, and thus serve to encourage the powers that be to extend equal favours to other suitable areas, as this is a direction in which vast possibilities are lying dormant, it should deserve the best attention of those immediately interested.

TABLE B.—Total Arrivals of Butter by Rail in Melbourne.

Total Arrivals in Melbourne from—	Butter, 1899.	Butter, 1900.	Butter, 1901.
	lbs.	lbs.	lbs.
Western and South-Western ...	13,744,416	13,537,888	11,781,280*
North-Eastern	15,179,584	16,448,992	10,788,288
Northern	6,360,704	7,718,148	5,666,528
Eastern and South-Eastern	16,185,344	16,801,792	19,243,840
Grand Total	51,470,048	54,506,820	47,479,936

* In 1901 1,270,780 lbs. arrived from the Western District by steamer; approximately a similar amount was landed during each of the two previous years.

NOTE.—Those figures are computed from returns kindly supplied by the Railway Department. As the Railway Department gives gross weights, 11 lbs. have been deducted from every 67 lbs. in the case of butter to allow for the weight of boxes. Eighty-five lbs. have been taken from every 125 lbs. in the case of cream, that is, 25 lbs. for the weight of cans, and every 100 lbs. of cream was estimated to contain 40 lbs. of commercial butter.

Comparison of Districts.

Whilst comparing the districts in regard to quantity, the question of quality might also be considered. Every reader of market reports of dairy produce for the last year or so will have noticed that Western

District butter is specially mentioned as bringing a higher price in the open market than that from other portions of the State, and, whilst Western District brands have been realizing 1s. 5d. per lb., other butters brought 1s. 4½d., 1s. 4d., 1s. 3d.. and even lower. We all know that some brands in other districts are equal in quality to that of the average Western District factory, but why should the produce of Western District factories be singled out in preference to that from elsewhere? The cause is attributed to the better control of the industry generally exercised there. Practically, the whole of the dairy factories are co-operative. There are no hand separators, the managers exchange visits, and this, coupled with their system of dairy inspection, which is more advanced than in any other portion of the State, is accountable for the accruing advantage. The co-operative element tends to give every supplier an interest in delivering his milk in the best possible condition to insure the manufacture of a good article. It was recognised that careless suppliers to a company had a detrimental influence on quality, and set a bad example to others, and that their supplies, when mixed with the bulk, tended towards lowering the quality of the whole. This did more than anything else to call into operation in the Western District a system of dairy inspection controlled by the dairymen themselves, which, although only in its inception, has already tended greatly to improve the quality, and might be copied with advantage by other dairying localities. The interchange of visits between the factory managers engenders a spirit of emulation. This also is a matter which might be commended to those who have not already adopted it.

The Home Separator.—The home separator is a great boon in its own sphere, that is, where the country is hilly or roads are bad, or where a dairyman is isolated from his neighbours; but, where roads are good, I have frequently pointed out that its use was not calculated to improve the quality of butter, because, in a climate like ours, it is essential to have the aid of artificial means—not procurable on the farm—for keeping the cream cool and controlling fermentation. The assistance of refrigerating machinery is only possible when large enough quantities are handled to warrant its expense.

The same community of interest does not exist with the cream supplier as with the co-operative milk supplier, for the former being free to send his cream in any particular direction is not brought under the improving influence of any factory manager, and those who are careless afford a bad example to all in their vicinity. The introduction of the home separator has in nearly every instance rendered nugatory the benefits derivable from the co-operative system, which was doing so much for those who had embraced it. Its adoption in places where co-operative factories existed was destructive of confidence in the quality of the output from that particular locality. I wish to point this fact out at the present time for two reasons: first, to retard its spread in districts where co-operative factories are flourishing; and, secondly, to show the greater necessity that exists for those who

have home separators to deliver their cream to the factories more frequently and in better condition, so that as good a quality of butter as possible may be made from it.

What becomes of our Butter.

In Table C is shown the destination of butter exported for the last three years. The South African and Eastern trade exhibits a very

TABLE C.—Summary of Victorian Butter Exported.

Total Export to—	Butter. Year ending 1899.	Butter. Year ending 1900.	Butter. Year ending 1901
	lbs.	lbs.	lbs.
United Kingdom	26,045,210	26,185,679	17,180,468
South Africa	3,905,300	4,745,107	6,428,684
Inter-State	5,718,560	5,716,222	4,575,532
Eastern and other Ports ...	568,399	1,146,153	961,709
Grand Total	36,237,469	37,793,161	29,146,393

considerable expansion, whilst the Inter-State and United Kingdom trade shows a falling-off which is due not to any decline in the demand, but rather to our inability to cope with it. Those figures deal with the calendar year, so that when the season comes to be dealt with even a greater discrepancy will be shown than is here indicated.

The growth of the trade in tinned butter has been enormous. About one-half of what is sent to Eastern ports and South Africa, together with a small proportion of that which goes to Western Australia, is now put up in this form.

The difference between the arrivals in Melbourne and the total exported, gives for each year the quantity detained here for Melbourne consumption; therefore, 16,503,359 lbs. was required in 1899; 17,984,439 lbs. in 1900; and 19,604,323 lbs. in 1901. An equal amount at least would be needed for the country, and if those figures are doubled, the total Victorian consumption will be as shown in Table D.

TABLE D.—Statement showing Total Production of Butter in Victoria for Three Years, 1899, 1900, and 1901.

Butter.	1899.	1900.	1901.
	lbs.	lbs.	lbs.
Consumed in Victoria	33,006,718	35,968,878	39,208,646
Exported	36,237,469	37,793,161	29,146,393
Total Production	69,244,187	73,762,039	68,355,039

This table exhibits a gradual increase in the local demand at the rate of about 3,000,000 lbs. of butter per annum.

Milk Blending.

A great deal of attention has latterly been directed towards the practices adopted by some English butter dealers. They extended a plan which has long been known and practised to a limited extent, that of adding moisture to the bulk butter. They impose on the consumer by adding what they describe as pure, sweet, fresh, full-creamed English milk to butter containing a low percentage of moisture such as that sent from Victoria, and selling it as milk-blended butter, leaving the purchasers to believe from the description that they were getting something superior to pure butter, when, as a matter of fact, they were getting pure butter with a large percentage of added moisture. This injures our reputation, as our best butter is intercepted on its way to the consumer, and utilized in this undesirable manner, so that its identity is obliterated. There is no doubt that butter with a large percentage of water added, lacks good keeping quality. It is patent that since the quality of butter has been improved by modern methods of manufacture the consumption of it as an article of diet has increased; therefore, anything which reduces its palatability will tend towards diminishing its use. To my mind it is nothing short of dishonesty to sell butter as such when it contains very much more than the average of a certain useless constituent which the purchaser has not bargained for. It may be said, and truly said, that the composition of the article is published, but how many of the general public really know the amount of moisture good butter should contain? I venture to say, very few indeed. This system of adulteration is spreading. Grocers who formerly confined their operations to their own particular retail trade, are now catering in a wholesale fashion for others in the same line of business, and other grocers find their legitimate trade so interfered with that they in self defence state that they must have recourse to similar tactics in order to maintain their business connexion. It is to be hoped that success will attend the efforts of those who are interested in urging Mr. Hanbury, the President of the British Board of Agriculture, to limit the percentage of moisture in butter to 14 per cent. or, at most, 15 per cent., and make it illegal to sell any butter as pure containing water beyond that percentage.

Shipping Temperature.—In the early part of the season the distinct advantage of having butter shipped at a low temperature was made evident. The very slight alteration in quality which took place in the samples stored below freezing temperature for the competition under the auspices of the Royal Agricultural Society confirmed the experience of the previous year in this direction. It was evident if butter could be landed in the same condition as those particular samples were in when opened, after having been subjected to an experience similar to that encountered by export butter, that it would be to our advantage. At the same time a considerable amount of other evidence was contributed in support of this contention. Messrs. Weddell and Co., in reporting upon the condition in which New Zealand butter was then arriving as compared with its condition some time before when a higher shipping temperature was maintained, pointed out that a great improvement

in quality was noticeable on its arrival in England. Mr. Taylor, Chairman of Directors of the Camperdown Butter Factory, who inquired into the matter when on a visit to England, found that the balance of opinion was strongly in favour of shipping at a lower temperature in order to minimize deterioration on the voyage. An effort was made by the department at the beginning of the year to have all butter brought to a temperature below freezing point before shipping, so as to reap the benefits which it had been made apparent would accrue therefrom. Two or three shippers objected at the time, and it was therefore considered inadvisable to place any other exporter at a disadvantage as a consequence, so, for the time being, the matter was suspended. However, in the past season, the shipping temperature was lower than that for some years before, and to this fact is due some portion of the better position we have attained on the English market. For those who last year were objecting, experimental lots of butter of typical qualities are being put into cool store to be kept at various temperatures in order to convert these few remaining unbelievers.

Conclusion.

In conclusion I have to express regret for the loss of my old and esteemed colleague, Mr. Potts, who has gone to New South Wales. Mr. Potts has done a great deal towards making dairying more attractive and popular in Victoria. By the appointment of Dr. Cherry to the position vacated by Mr. Potts we have secured a friend who has already done good work. I know all dairymen will welcome him as I do into a sphere where there is still plenty of scope for advancement. Every one engaged in dairying with whom I have come in contact recently is full of hope. The present shortage is regarded as due to the drought and the war. Many intend to profit by past experience, and by making better provision for their stock, with a return to normal seasons, the industry will progress as it has never done before. That these anticipations will be fully realized is my earnest wish, and no stone will be left unturned to secure that end.

REPORT OF THE DIRECTOR OF THE VITICULTURAL STATION.*

R. Dubois, B.Sc.

Inspection of Vineyards.

The outbreaks of phylloxera and consequent apprehension of its spread were responsible for a check in the extension of vineyard areas, but a commencement was made during 1900 and 1901 with the planting of American and Franco-American phylloxera-resistant stocks, with a view to reconstitution of vineyards on a satisfactory basis. During last year increasingly large numbers of these resistant vines were distributed in most of our viticultural districts, and many of these are doing well, and testify to their adaptability to our soils and climate.

A large proportion of the work of the year has naturally been in connexion with these American vines, their removal from Balaclava and Cheltenham to the Head Station, Rutherglen, their subsequent distribution throughout the State, and their planting and growth, not only in the Government district experiment stations, but also in the vineyards where they have been distributed by the Department and planted by private enterprise. Many of these latter have made almost phenomenal growth. Valuable data are being collected and recorded regarding their adaptability to the various conditions of soil and climate prevailing in the different districts, and in this connexion the following is extracted from a special report submitted by Inspector Adcock :—

ORDER OF MERIT OF THE AMERICAN VINES IN THE DISTRICT EXPERIMENT VITICULTURAL STATIONS.

No. 2.—Mooroopna.

1. Couderc Hybrids, Nos. 3306 and 3309 (about equal).
2. Riparia grand glabre.
3. Rupestris Martin (very badly attacked by Termites).

No. 3.—Bendigo.

1. Couderc Hybrid, No. 3306.
2. Riparia gloire de Montpellier.
3. ,, grand glabre (poor).
4. Rupestris du Lot (poor).
5. Rupestris Martin (very poor).

No. 4.—Great Western.

1. Couderc Hybrid, No. 3306.
2. Rupestris Martin.
3. Riparia gloire de Montpellier.
4. ,, grand glabre.

* See Parts 4 and 5 of the present Journal for 1st and 2nd Progress Reports.

VITICULTURAL STATION, RUTHERGLEN. VIEW OF MAIN BUILDING AND LODGE.

No. 5.—Tabilk.

1. Condere Hybrid, No. 3309.
2. Riparia gloire de Montpellier.
3. Rupestris Martin } poor.
4. Riparia grand glabre } poor.

No. 6.—Ararat (Warra Yadin).

1. Condere Hybrid, No. 3309.
2. Rupestris Martin.
3. Riparia gloire de Montpellier.
4. Riparia gland glabre.

No. 7.—Geelong (Batesford).

1. Condere Hybrid, No. 3309.
2. Rupestris Martin.
3. Riparia gloire de Montpellier.
4. ,, grand glabre.

ORDER OF MERIT OF THE AMERICAN VINES GROWN IN PRIVATE VINEYARDS.

Goulburn Valley.

Mr. T. Darveniza's Vineyard, Mooroopna.

1. Conderc Hybrid, No. 3306.
2. Riparia grand glabre.
3. Rupestris Martin.
4. Rupestris du Lot. / Riparia gloire, &c.

Mr. J. Foster's Vineyard, Ardmona.

1. Riparia gloire, &c.
2. Rupestris Martin.

These vines afford an interesting object lesson. They were planted on the exact sites of vines destroyed by phylloxera. On either side of some are vigorous European varieties. The resistant vines have done remarkably well, and afford valuable testimony to the efficacy of American vines in phylloxerated areas.

Mr. A. Lenné's Vineyard, Ardmona.

1. Riparia gloire: the only variety planted out is doing well.

Mr. Carl Lenné's Vineyard, Ardmona.

1. Rupestris du Lot (best average growth).
2. Rupestris Martin / Riparia grand glabre } about equal.

It is hard to say among these three varieties which is actually the best. The two latter varieties show much more vigorous specimens, but the result is not so uniform.

Mr. W. H. Prossor's Vineyard.

Riparia gloire de Montpellier and Rupestris du Lot are both doing well as seen by photos sent.

Château Tahbilk Ppty. Ltd.

1. Rupestris du Lot.
2. Riparia gloire de Montpellier.

It will be seen that where they have been planted the Conderc Hybrids are always first. In the Goulburn Valley, where irrigation is practised, the Riparias succeed well.

It is satisfactory to notice the interest aroused among individual vignerons regarding these stocks. Information is eagerly sought and gladly imparted regarding them, their treatment, methods of grafting, budding, &c. On almost every vineyard visited this information is thankfully acknowledged. It is also pleasing to find that with but rare exceptions the growers not only advocate, but carry out, deep cultivation in preparation of land for reconstituted vineyards.

As was expected in the areas already known to be phylloxerated, the pest is slowly but steadily extending its operations, infecting larger areas in the same vineyards, and also attacking vines on adjacent properties. It is, however, a matter for congratulation that new outbreaks have only been hitherto discovered in one other parish not already indicated as diseased in the map issued with the annual report for 1900. This is the parish of Mitchell, in the county of Dalhousie. The effect of the series of dry seasons, combined with phylloxera attacks, has been noticeable in the rapid destruction of affected vines, especially in northern areas. White ants have here and there in limited patches been responsible for considerable injury to vines by tunnelling the stocks and larger roots, and have doubtless come from the roots and stumps of the forest trees which have been allowed to remain in the ground.

Fungus diseases were not on the whole of a very serious nature, owing probably to the climatic conditions not being so favorable to their extensive development, as well as to preventive methods adopted. Pourridié is found, as might be expected, in soils where natural drainage is defective, and, unfortunately, artificial drainage is rarely practised. Frosts were rather severe in some localities, while hail and violent storms were frequent, and, consequently, responsible for considerable local damage.

The vineyards in general are well looked after, and, in fact, leave but little to be desired. Cultivation is usually thorough. It is the exception to find it neglected, as growers have found that the crop is usually in proportion to the care exercised in this respect, and that constant stirring and keeping a loose surface pay well. It is an absolute necessity where the rainfall is as limited as it is in most of our viticultural centres. In the rare instances where cultural methods are neglected it is almost amusing to hear the excuses so readily advanced, the most frequent one being that the weeds are being left for ploughing in as manure.

It is to be regretted that the practice of sowing some leguminous plants for ploughing in as green manure is not more general. Where it has been adopted it gives excellent results, enriching the soil by the addition of nitrogenous and other valuable manurial substances; adding humus, in which so many of our northern soils are deficient; and acting most beneficially also in a mechanical manner, especially in compact soils. While not yet done extensively, we are glad to notice the practice is growing in favour, and will, it is hoped, soon become the rule instead of the exception.

The following table shows the areas inspected during the seasons 1900–1 and 1901–2, and the number of acres at present affected by phylloxera in each parish of the State:—

TABLE SHOWING AREAS UNDER VINES AND AFFECTED BY PHYLLOXERA IN EACH PARISH.

Parish.	Area under Vines.	Area affected by Phylloxera.	Number of Vine-yards affected.
	COUNTY OF BOGONG.		
Barambogie	10	...	...
Baranduda	70	...	...
Barnawartha North	902½	...	...
Barnawartha South	310½	...	...
Barwidgee	4½	...	...
Beechworth	101½	...	...
Belvoir West	5	...	...
Bontherambo	203½	...	...
Boorhaman	161	...	...
Bright	12	...	...
Brimin	155	...	...
Byawatha	58	...	...
Carraragarmungee	134½	...	...
Carlyle	3,159	80	12
Chiltern	190¾	...	...
Chiltern West	652½	8	2
Estcourt	16	...	...
Everton	22	...	...
Gooramadda	1,735	15	2
Lilliput	1,907½	12	2
Mudgegonga	10	...	...
Norong	704½	...	...
Stanley	1	...	...
Tarrawingee	90	...	...
Wandiligong	13	...	...
Wangaratta North	162	...	...
Wodonga	137½	...	...
Woorragee North	214	...	...
Yackandandah	116	...	...
Total	11,258½	115	18
	COUNTY OF MOIRA.		
Balmattum...	½	...	...
Benalla	13½	...	...
Boomahnoomoonah	98	...	...
Boosey	1	...	...
Boweya	34	...	...
Bundalong...	40½	...	...
Bungeet	44½	...	...
Burramine	20	...	...
Burramine South	6	...	...
Caniambo	10	...	...
Carrowa	135	...	...
Dargolong	9	...	...

TABLE showing Areas under Vines and affected by Phylloxera, &c.—*continued.*

Parish.	Area under Vines.	Area affected by Phylloxera.	Number of Vine-yards affected.
COUNTY OF MOIRA—*continued.*			
Devenish	37½	...	...
Dookie	940	...	...
Euroa	3½	...	...
Glenrowan	72	...	...
Goorambat	9½	...	...
Karrabumet	165	...	...
Kialla	54½	...	...
Mokoan	15½	...	...
Peechelba	49½	...	...
Pine Lodge	50	...	...
Pelluebla	25¼	...	...
Shepparton	92	...	...
Shadford	34	...	...
Stewarton	22¼	...	...
St. James	5¾	...	...
Tabilk	496	205	6
Taminick	76	...	...
Tharanbegga	5	...	...
Tallygaroopna	73	...	...
Upotipotpon	11	...	...
Waggarandall	42½	...	...
Wangaratta South	9	...	...
Warrenbayne	5½	...	...
Willis	13	...	...
Yarrawonga	180	...	...
Youarang	23	...	...
Total	3,008¼	205	6
COUNTY OF RODNEY.			
Bailieston	78½	36	3
Campaspe	25	...	...
Colbinabbin	8	...	...
Corop	40	...	...
Kyabram East	60	...	...
Moira	55	...	...
Moora	34	...	...
Mooroopna...	1,018¼	214	28
Mooroopna West	21½	...	...
Murchison North	9	...	...
Noorilim	25	...	...
Runnymede	73	...	...
Toolamba	191¼	17½	3
Toolamba West	80½	...	...
Tooleen	20	...	...
Waranga	5	...	...
Whroo	7	...	...
Total	1,751	267½	34

TABLE showing Areas under Vines and Affected by Phylloxera, &c.—*continued.*

Parish.	Area under Vines.	Area affected by Phylloxera.	Number of Vineyards affected.
COUNTY OF DALHOUSIE.			
Heathcote ...	20	Phylloxerated area uprooted previous to 1899	
Mitchell ...	105½	10	3
Moorlbool West	46	...	...
Total	171½	10	3
COUNTY OF GRANT.			
Barrabool ...	44	...	...
Carrah ...	4	...	...
Connewarre	7	...	...
Darriwell ...	15	...	...
Duneed ...	70	3	1
Gheringhap	15	...	...
Gnarwarre ...	13	...	...
Jan Juc ...	5	...	...
Moorpanyal	25	...	...
Murgheboluc	7	...	...
Paraparap ...	7	...	...
Puebla ...	5	...	...
Wabdallah	35	...	...
Worn-Yallock	8	...	...
Total	260	3	1

All the vines growing in this county were destroyed some 20 years ago on the first outbreak of phylloxera, and but little replanting has been done.

Parish.	Area under Vines.	Area affected by Phylloxera.	Number of Vineyards affected.
COUNTY OF GLADSTONE.			
Avoca ...	40	...	...
Bealiba ...	58	...	...
Bet Bet ...	268	...	...
Kangderaar	37	Phylloxera area uprooted previous to 1899	
Kingower ...	4	Phylloxera area uprooted previous to 1899	
Waanyarra	44	...	...
Wedderburn	50	Phylloxera present previous to 1899 in township gardens	
Total	501	...	...
COUNTY OF BENDIGO.			
Axedale ...	14	...	...
Bagshot ...	44	...	...
Bamawm ...	25	...	...
Bridgewater	6	...	...
Echuca North	20½	...	...
Ellesmere ...	14	...	...
Eppalock ...	19	3	1
Goornong ...	36	...	...
Huntly ...	605	·43	(?)
Lockwood ...	50½	...	...
Mandurang	135½	32	6

TABLE showing Areas under Vines and Affected by Phylloxera, &c.—*continued*..

Parish.	Area under Vines.	Area affected by Phylloxera.	Number of Vineyards affected.
COUNTY OF BENDIGO—*continued*.			
Marong	24	...	...
Nerring	52	...	...
Neilborough	9	...	...
Nolan	25	...	...
Rochester East	7½	...	...
Rochester West	21	...	...
Sandhurst	35	...	...
Sedgwick	18	63½ (destroyed)	...
Shelbourne...	16	...	...
Strathfieldsaye	55	632 (destroyed)	...
Surrumberg	7	...	...
Wellsford	24	Phylloxera area destroyed previous to 1899	
Woodstock...	6	...	...
Yarraberg	3	...	...
Total	1,272	78	(?)
COUNTY OF DELATITE.			
Balmattum	1	No phylloxera present.	
Benalla	9½		
Boho	3½		
Euroa	13		
Oxley	104		
Shadforth	1		
Warrenbayne	2		
Total	134		
COUNTY OF ANGLESEY.			
Mangalore	24	No phylloxera present.	
Worrough	8		
Total	32		

COUNTY OF BORUNG.

Parish.	Area under Vines.	Parish.	Area under Vines.
Ararat	176¼	Glynwylln	8
Bellaura	4	Horsham	76½
Bungalally	44	Illawarra...	31
Callawadda	36½	Jallukar	6
Concongella	753½	Joel Joel	3
Crowlands	3	Kirkella	12½
Dunneworthy	120	Langi-Ghiran	50

TABLE showing Areas under Vines and Affected by Phylloxera, &c.—*continued.*

Parish.	Area under Vines.	Parish.	Area under Vines.
	COUNTY OF BORUNG—*continued.*		
Ledcourt	101½	Warranook	16
Lexington	333	Warrak	37
Mount Cole	*9*	*Warra Warra*	*9½*
Moyston	12	Watta Wella	137
Riachella	3½		
Stawell	180	Total	2,328¾
Vectis East	166		

This county is free from phylloxera.

Parish.	Area under Vines.	Parish.	Area under Vines.
	COUNTY OF KARA KARA.		
Crowlands...	50	Mount Cole	3
Elmhurst	21	Warrenmang	70
Eversley	58		
Landsborough	3½	Total	226½
Lexton	21		

This county is free from phylloxera.

Parish.	Area under Vines.	Parish.	Area under Vines.
	COUNTY OF RIPON.		
Ararat	20	Warrak	5
Burrumbeet	10		
Dunneworthy	20	Total	65
Mount Cole	10		

This county is free from phylloxera.

Parish.	Area under Vines.	Parish.	Area under Vines.
	COUNTY OF TALBOT.		
Bet Bet	69	Maryborough	12
Eddington	20		
Lexton	12	Total	113

This county is free from phylloxera.

Parish.	Area under Vines.	Parish.	Area under Vines.
	COUNTY OF EVELYN.		
Gruyere	78½	Yering	503½
Mooroolbark	2		
Wandin Yallock	3½	Total	587½

This county is free from phylloxera.

MILDURA.

Total area, 3,955 acres, free from phylloxera.

Inspection of the Mildura Irrigation Colony.

A special inspection of the Mildura Irrigation Colony was made during February, March, and April of the present year, this being the only vine district that was not inspected during the season 1900–1.

The settlement was happily found to be free from phylloxera, as may be seen from the following extract from a special report submitted by Inspector Wyatt :—

"Wherever you find vineyards well kept and cultivated, it is a sign that the growers are getting good returns from their land ; or, if they are not, it is not altogether their faults. This applies to the vine-growers of Mildura, for, generally speaking, the blocks are well kept and thoroughly cultivated. The vines, with the exception of the Gordo Blanco, are healthy and free from fungus diseases.

"Anthracnosis and broussin (black knot) exist on the Gordo Blanco to a certain extent throughout the settlement, and growers should make great efforts to free their vines from these diseases.

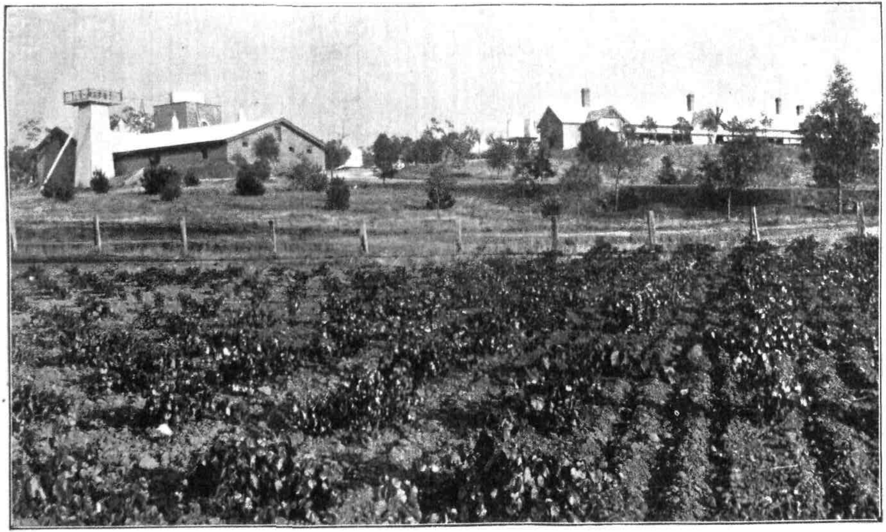
"No trace of oidium or mildew could be found anywhere, which proves that these diseases have not made their appearance for the last two seasons at least, and that the use of sulphur is waste of material and labour for the present. The settlement is so far free from phylloxera, and the settlers should endeavour to keep it so as long as possible, and at the same time prepare for its inevitable arrival by planting vines grafted on American resistant stocks. About 800 acres of vines were planted this season (most of it being land that had been planted with fruit trees that had been uprooted) which brings the total area under vines to 4,000 acres. Many acres of fruit trees are being destroyed, and vines are to be planted this coming season in their stead. The phylloxera question is therefore of the most serious importance to the settlers. How to keep the insect from being introduced, and also the best way of preparing for it when it does come, are the two most important questions to solve for the present.

"There is now a greater area under vine cultivation than all other plants put together, crop and lucerne included. The vine stands salt seepage better and lasts longer than any fruit tree, except, perhaps, the fig, and the vine has really become the backbone of Mildura.

"As a rule, the land is well worked, but in many vineyards a 'plough sole' has been formed at about 5 or 6 inches from the surface. This should be broken up in the winter, as it prevents the water from reaching the subsoil easily, is apt to make the surface soil puddle, and does not allow the vine to establish its roots deeply. By subsoiling the centre of the rows and deep ploughing, not too near the vines, this 'plough sole' would be broken up, and where vines are not trellised this should be done in a direction opposite to that of the irrigation furrows.

"Rutherglen bug was a great trouble in many blocks early in the season, but did not cause much damage to the vines, as it disappeared after the first hot winds.

"The Sultana vine does particularly well in the Mildura settlement. It stands more salt than either the Zante currant or the Gordo Blanco, thrives better on the stiffer soils than the latter, and is almost free from fungus diseases. I only found anthracnosis on a few Sultanas, but was informed that during season 1894–5 all vines were very badly affected both with anthracnosis and oidium. Spraying and swabbing has been extensively carried on until the last two seasons.



GENERAL VIEW OF VITICULTURAL STATION, RUTHERGLEN.

"The great difficulty with salt seepage has not yet been overcome. In several places vines and fruit trees are dying through no other cause, the outward appearance of the vines resembling that of chlorosis in many cases. In many blocks the soil is so very rich in salt that it will not allow even the Sultana to grow, and in several of these places the American resistant vines (Solonis) may grow to advantage and serve a double purpose.

"There were many fine crops of grapes in the settlement, several blocks of Gordo Blanco yielding 2 tons of raisins to the acre. The Sultana crop was heavy throughout, one block giving 2½ tons of dried fruit per acre; 10 tons of dried and packed Zante currants were gathered off 4 acres, but this must not be taken as an average crop. One is struck with the rapid growth vines make in this settlement, many blocks of both Gordo Blanco and Sultanas that were only planted last September had this season 8 and 10 feet of growth. In some instances these were planted as cuttings."

REPORT OF THE CHIEF INSPECTOR OF STOCK.

J. R. Weir.

The information received from the different inspectors stationed in districts, and on the borders, from which I am compiling this, my first report, covering a period of five months only, consists in most instances of dreary tales of drought and desolation. Fortunately there is also a bright side, as the districts south of the Dividing Range have as usual received a fair share of moisture, and with the mild weather experienced this autumn growth has been good. In most parts of Gippsland prosperity is general—sufficient rain, without floods, has fallen, crops have been good, and prices are still high for both fat stock and produce of all kinds. In the northern areas the drought has caused terrible loss. Along the Murray, lambs are being destroyed to try and save the lives of the ewes, but even yet, if a plentiful supply of rain falls this winter, good times for both the farmer and the community at large may be expected, as the crops have still a chance, and as the country is lightly stocked the survivors will have an abundance of feed.

All are agreed that the present scarcity should impress on the farmers the absolute necessity of making more preparation for feeding their stock, and not depending too much on unaided nature, as has hitherto been done.

Sheep have been very healthy, and very little fluke was noticeable, on account of the dry seasons. One case of water-rot in the Western District produced a heavy mortality. This was caused by running sheep on unsuitable land—badly drained and swampy.

In Inspector McKenzie's report he states lung worms are always prevalent in his district, but they are kept in check by giving arsenic drenches (arsenic, tobacco, and washing soda).

The lambing, according to the reports, is going as high as 80 per cent. in some cases; in others it will be very low.

Compulsory dipping appears to be favoured by most people, but they forget that it means more legislation and inspectors, consequently extra expense. Stock-owners, like most other people, are not volunteers for paying expenses they can avoid, hence the objection to compulsory dipping.

Pleuro-pneumonia has been rather plentiful, but by destruction of the diseased animals, quarantine, and inoculation of the contacts, it has been kept well in check, and at present there are but few cases. Owners are compelled by law to immediately report outbreaks, and even for their own sakes they should do so, as it is to their interest, as well as the public generally, that the disease should be stamped out.

Tuberculosis is each year becoming less prevalent, partly through greater knowledge on the part of the owners, but principally through inspection.

Actinomycosis, or lumpy jaw, is being continually found. In the early stages it is curable, and owners are instructed how to treat it, but the incurables are destroyed, as the complaint is then chronic and contagious.

Heavy losses were experienced by stock-owners in the Western District during the last season through the want of nourishment in the food, produced by deficiencies in the soil, and these will have to be supplied artificially if dairying is to be carried on successfully in that locality.

Fluke and hydatids in cattle have not been so prevalent lately, owing to the dry nature of the seasons, so drought has some compensating advantages.

Horses have been very free from disease. A few cases of influenza, strangles, and string-halt have occurred, but the losses from them have been light.

Bots have been blamed for a few odd deaths, but these are rare where the animals receive proper nourishment. Want of food has caused more deaths. The poor horse is then compelled to eat up anything or everything, including sand.

Pigs have been very healthy, the exception being where badly-constructed and badly-drained styes are used, resulting in broncho-pneumonia and other lung troubles. Tuberculosis is also found occasionally amongst them.

Very little disease has been found in poultry; a few cases of diphtheria and roup have been discovered and dealt with. The dreaded tick has been found in some of the northern areas, and these have been quarantined, and no fowls can now be brought out of the infected districts. All fowls coming from the adjoining States where the tick is known to exist are carefully examined before introduction, and their crates disinfected with formalin.

Attached hereto are reports from the district inspectors, imports and exports by sea and land, statements of all stock inspected in the State, diseases found and animals destroyed, and a summary of all the border inspectors' reports. They contain some very interesting matter, and from them a slight idea of the extent of the drought in New South Wales can be conceived by records given of the exports of fodder at some of the stations.

Central District.

MR. LAWLER'S REPORT.

CATTLE.

Never during the past thirteen years has this district been so free from disease.

Pleuro-pneumonia has only been found in two small herds on the Upper Goulburn. Immediate steps were taken to inoculate, and the properties at once quarantined. The disease made no headway, and was soon stamped out.

Tuberculosis is also on the decrease, more especially in the Goulburn Valley district, where some years since it was very prevalent; each month the average killed would exceed twenty head. Reports from police and others of its occurrence reached me almost daily. There have only been two cases in the Valley for the last five months. This satisfactory state of affairs is due in a great measure to the diligent and

general inspection I made of all the dairy herds there three or four years ago. Owners were urged to be present at *post-mortem* examinations made on diseased animals; as many as twenty farmers have been present sometimes when, perhaps, six beasts differently affected were examined. As a rule, they would go away highly pleased, and were in a position to enlighten their neighbours. Now, in the case of animals becoming affected, owners kill them themselves, without calling in the services of the inspector of stock, by this means materially assisting him to stamp out and eradicate the disease.

Actinomycosis.—I have met with a few cases of this disease, which is commonly known as "Lumpy Jaw," in portions of the North-Eastern District, and in most cases advised as to treatment, *i.e.*, whenever found in the incipient stage, and in advanced stages ordered the destruction of the animals. Mere excision of lumps, without further treatment, is useless, and when dealing with animals far gone, in order to prevent ultimate loss and save the time of owners, I have found destruction the better means. It has come under my notice that stock-owners, mistaking Tuberculosis for Actinomycosis, even when in its last stages, have attempted, by cutting open lumps on the glands or affected region, to bring about a cure, wasting their time in a vain and useless effort. I invariably discourage the curative process, as in the case of milch cows the putrid matter emanating from the wound is scattered about the milking sheds, disseminating disease, instead of checking it.

Spinal Apoplexy in cattle is on the wane during the past couple of years. Two cases were met with in the month of January, and each succumbed.

Dry Murrain or Impaction seems not to have claimed as many victims as usual. Notwithstanding the dry season, very few cases have come under my notice.

Anthrax.—In a small herd at Barnawartha a suspected case occurred, as also in a flock of sheep in the same locality; as a result, ten head of cattle and twenty sheep died. Vaccination was performed in both instances, and no deaths occurred afterwards.

Pigs.

In a herd of 200 pigs near Melbourne, I discovered two cases of Tuberculosis. Both animals were destroyed, and the erection of new styes with improved drainage was ordered.

Horses.

No complaint has reached me of an epidemic among horses, although at Corop two valuable draught animals succumbed to the attacks of the bot-fly, following on mal-nutritious pasture.

Sheep.

Want of feed and not disease is the cause of death in the Central District. North of the Dividing Range, *i.e.*, in the North and North-Eastern Districts, this is the driest season experienced for years. The paddocks wear a parched appearance, and stock are starving for lack of food and water. In many cases dams, water-holes, and creeks are dried up, and

this, too, in localities never before similarly situated. Ploughing has been retarded owing to the continuous drought, in some cases wheat, though sown two months since, is not yet over ground.

South Gippsland.

Having had occasion to visit South Gippsland during the last few months, two or three cases of Pleuro-pneumonia were found to exist in different herds, the whole of which I placed in quarantine after having first ordered the destruction of all affected animals. In quarantining contacts, I instructed owners how to procure virus, and gave a demonstration in inoculation, urging them to operate similarly on all their contacts at once. These instructions have been carried out to my satisfaction, and I am happy to state the disease seems to be stamped out in that locality.

Herewith I append report of inspections made by me from 1st January to 31st May, 1902:—

Dairy.

Month.	No. Inspected.	No. Milking.	Pleuro-pneumonia.	Tuber-culosis.	Actinomy-cosis.	Other Diseases.	Killed.	Isolated.
January ...	1,016	699	3	1	...	1	4	1
February ...	1,033	584	...	4	...	3	7	...
March ...	1,596	958	1	2	...	3	...	8
April ...	1,491	1,102	...	2	1	...	2	1
May ...	2,701	1,874	3	8	...	...	10	...
	7,837	5,217	7	17	1	7	23	10

Dry.

Month.	No. Inspected.	Pleuro-pneumonia.	Tuber-culosis.	Actinomy-cosis.	Other Diseases.	Killed.	Isolated.	—
January ...	207	...	...	...	...	...	...	...
February ...	144	...	...	3	...	...	3	...
March ...	278	...	...	1	...	1	2	...
April ...	1,675	...	...	...	...	1	1	...
May ...	1,845	3	6	...	1	...	10	...
	4,149	3	6	4	1	2	16	...

Bairnsdale District.

Mr. McKENZIE'S REPORT.

In cattle this district is now very free from disease, though odd cases of tuberculosis occur, and during the dry weather cripples, but since the rain in March, which made a good spring in the grass, the latter has disappeared. Horses have been very free from any diseases;

string-halt is only seen occasionally, and one or two deaths from bots have been brought under my notice. In sheep there have been few losses; fluke does not thrive here in dry seasons, and nearly all owners dip for lice and tick with the various mixtures made for this purpose. Worms are always troublesome in some localities at certain times, but by using an arsenic drench few losses occur from this cause, and, on the whole, the sheep are now sound.

At present I do not know of any pleuro-pneumonia in this district. The last case was J. L. Allman's, near Sale. I quarantined his land and stock, and had the cattle inoculated; the disease was stopped at once, and their cattle are now sound. In milking cows, I slaughter any showing signs of disease, and inoculate the balance, quarantine the stock, but allow the milk to be sent away after the regulation time has expired, and in all cases this treatment has been successful.

All breeds of cows are used in the dairy herds here; the general opinion just now seems to be in favour of a shorthorn cross, the best, I think, being the cross with the Ayrshire. I have not found any cows being milked with diseased udders, all the shires here have now dairy inspectors, and the inspection is fairly strict.

There is room for improvement in some of the milking sheds, but there has been a great deal done in the way of new sheds and improvements. The most difficult cases to deal with are where men are renting the farm, perhaps on a short lease, and the landlords will not allow them anything for improvements.

Anthrax is not known in this district, and the general condition of the stock is good. We had a dry summer, but the rain came in the autumn, and the grass grew quickly, and all stock are now in good condition. The weather during April and May has been warm and mild, and as further useful falls have occurred, the prospects for the winter are very bright. The crops grown have all been good, principally oats and maize, and the big demand for feed of any kind for the drought-stricken districts at good prices has filled the farmers' pockets. The maize yields are not quite so heavy as they have been in other years, owing to the dry summer, but I think on the Lindenow flats there would be an average of 60 bushels per acre, and that at present prices is good enough. Land is increasing in value, and hard to get.

Kangaroo grass is the best native summer grass, and the barley grass on the good land affords a fair bite in the winter. In artificial grasses rye grass seems to take the lead in this district, prairie and cocksfoot coming next. Lucerne is grown on a small scale, and I think will be more generally cultivated, as it comes in in the summer time when most grasses are dried up.

The last lambing was good, and early lambs for this season are now beginning to show up in the paddocks. The class of sheep kept are mostly cross-breds, the climate being too wet for Merinos, the Lincoln and Shropshire being most favoured. All kinds of dipping mixtures are used, and it is hard to say which is most in favour. Dipping is not as general as it should be, and as there is a great deal of traffic in sheep, many do not expect to keep them long, and will not go to the trouble of dipping.

The principal crops grown are oats, principally for hay, and maize. For green feed for dairy cattle, barley and rye. Beet is grown to a moderate extent for winter feed. In some parts pumpkins are largely used, though some dairymen consider them too fattening for milk cows. All stock seem to take to them.

RETURN of Cattle, other than Dairy Cattle, inspected during the Five Months ending 31st May, 1902, in the Bairnsdale District.

Month.	No. Inspected.	Pleuro-pneumonia.	Tuberculosis.	Other Diseases.	No. Killed.	No. Isolated.
January ...	2,980	...	...	...	...	...
February ...	3,720	1	...	...	1	...
March ...	3,660	...	2	3 lumpy jaw	5	...
April ...	3,110	...	...	...	...	...
May ...	7,410	...	...	...	...	...
	20,880	1	2	3	6	...

RETURN of Dairy Cattle inspected during the Five Months ending 31st May, 1902, in the Bairnsdale District.

Month.	No. Cattle.	No. Milking.	Pleuro-pneumonia.	Tuberculosis.	Other Diseases.	No. Killed.	No. Isolated.
January ...	2,301	1,025	...	...	...	...	2
February ...	1,517	796	...	1	...	1	...
March ...	441	189	...	...	...	...	...
April ...	1,578	995	...	1	...	1	...
May ...	2,156	1,307	...	...	...	...	...
Totals ...	7,893	4,312	...	2	...	2	2

Geelong District.

MR. COTHER'S REPORT.

The whole of the district under my control, with the exception of a comparatively small area embracing Geelong, Werribee, and Bacchus Marsh, is experiencing a very bad time for the want of rain. In the Western and Northern divisions the autumn rainfall has been very light, consequently, except in the stony rises and volcanic country, there is very little feed. The cattle are in very poor condition, fat stock is scarce and likely to see very high prices during the coming winter. Even should heavy rain fall soon, it is next to impossible that a good growth of grass would result, the shortening days and colder weather which would be expected to follow would operate against such a desirable result, although it is not too late even yet for the Northern areas to benefit thereby. The only hope now is that the winter rains will be abundant and followed by a genial seasonable spring, for in that case the next season would make up to some extent for the present, but as it is many of the oldest graziers say that they have never seen things so bad.

The outlook being so gloomy, dairymen and graziers are afraid to increase their stock, consequently there is little traffic in stores or milking cows unless in the case of the disposal of a good dairy herd, as was the case at Pirron Yallock where the record prices for cows were obtained. A season such as the present will teach many dairy farmers a bitter lesson which if it results in the system of overstocking practised in the past being discontinued, must be to their ultimate advantage.

In many instances the seed-wheat sown has not germinated, and a second sowing will have to be resorted to, though all hope of a good harvest need not even yet be abandoned.

The prospects of lambing are poor. The early lambs are being killed in order to save the ewes. With the losses of lambs the prospects of the freezing industry are likely to be seriously affected.

Stock Diseases.

The "Yambuk" disease has continued to claim its victims, the bad season contributing largely to the mortality. Pleuro-pneumonia is quiescent just now, and it is to be hoped that the spring time will not see its recurrence. Comparatively few cases of tuberculosis have come under my notice during the last half-year. Actinomycosis still continues to be very common, especially in northern districts, but less so in those where the operative treatment is practised. Strangles have been rather prevalent of late. All the cases that I have seen have been under treatment by practitioners. I have seen no acute cases of string-halt and only an occasional chronic case. No cases of anthrax have come under my notice. In every dairy herd there is one or more cases of lost quarters, the result in most cases of mostitis. I have seen but one case of tubercular udder; the cow is to be destroyed.

Dipping is commonly practised by the larger sheep-owners and should be made compulsory; if that were done the wool clip of the State would be considerably enhanced, a result that I am confident would also follow the supplying of bone-meal licks for sheep on the poorer country. Some sheep-owners are about to test the value of such treatment, the results will not of course be known until the shearing after the coming one.

Fowl tick is, I believe, prevalent in the Swan Hill portion of my district, but I have not yet had an opportunity of visiting those parts.

Return of Stock inspected in the Geelong District, from 1st January, 1902, to 31st May, 1902.

DAIRY.

Month.	No. Inspected.	No. Milking.	Pleuro-pneumonia.	Tuberculosis.	Other Diseases.	Isolated.	No. Killed.
January	1,104	708	9	...	1	...	2
February	1,459	925	1	1	...	...	2
March	864	439	4	...	2	...	5
April	216	170	...	1	1	...	2
May	932	591	...	1	3	...	1
	4,575	2,833	14	3	7	...	12

OTHER CATTLE.

Month.	No. Inspected.	Pleuro-pneumonia.	Tuberculosis.	Other.	Killed.	Isolated.
January	2,366	...	2	2	4	...
February	2,000	...	...	6	5	1
March	20	...	1	1	2	...
April	3,374	...	3	1	1	3
May	1,256	...	...	...	...	...
	9,016	...	6	10	12	4

Warrnambool and Wimmera Districts.

REPORT BY MR. HAINES.

There is not much disease in stock at present, but there have been a good many deaths in cattle from impaction owing to the dry season. Some horses have died in the Wimmera from sand causing stoppage and inflammation of the intestines. I have not heard of any pleuro-pneumonia.

The pastures are in a bad state owing to the continued dry weather. Near the coast where there are coastal showers and fogs, things are not so bad. North of Hamilton grass and water are scarce, and in the Wimmera the drought is already causing deaths in both sheep and cattle.

The lambing is likely to be a poor one especially in the North-West Wimmera.

Dairy farmers are now beginning to realize that to make dairying a success, more food must be grown to feed their cows in the winter and in bad seasons.

RETURN of Cattle inspected in the Warrnambool District by W. Haines, District Inspector of Stock, from 1st January, 1902, to 31st May, 1902.

DAIRY CATTLE.

Month.	No. Inspected.	No. Milking.	Pleuro-pneumonia.	Tuberculosis.	Other.	Killed.	Isolated.
January	1,428	1,052	2	...	...	1	1
February	1,261	943	...	...	8	8	...
March	1,098	812	...	1	1	1	1
April	1,245	901	...	1	...	1	...
May	1,423	939	...	...	...	...	...
	6,455	4,647	2	2	9	12	2

OTHER CATTLE.

Month.	No Inspected.	Pleuro-pneumonia.	Tuberculosis.	Other.	Killed.	Isolated.
January	1,837	...	1	...	1	...
February	1,560	...	1	...	...	1
March	1,275	...	...	...	...	...
April	2,050	...	1	...	1	2
May	1,640	...	...	...	...	...
	8,362	...	3	...	2	3

Border Inspectors' Reports.

From the various reports received the health of stock in general appears good.

Tick in Poultry is prevalent from Mildura to Echuca, along the Murray River, within a narrow and sparsely populated radius. No poultry is sent from Mildura owing to its isolated position.

Actinomycosis.—A few cases have been recorded at Cobram, Yarrawonga, Lockhart, and Nelson.

Tuberculosis.—At Tocumwal, thirteen head of cattle, which were suffering from this disease, were refused admission into the State; but here, as at Yarrawonga, a few cases have occurred.

String-halt in the Horse.—A few cases have been reported from different stations.

Tick in Sheep.—Prevalent on the South Australian Border, but kept well in check by dipping.

Pleuro-pneumonia.—A few cases at Wodonga, one each at Tocumwal and Gooramadda; but the destruction of affected animals, inoculation of contacts, together with strict quarantining, has proved successful in stamping disease out in these places. Two mobs of cattle suffering from pleuro-pneumonia were refused admission into the State.

Dairy Cattle.

No pure breed is generally adopted, but different crosses, between such breeds as Ayrshire, Jersey, Alderney, Hereford, and shorthorn, owners using those adapted to the various localities.

Yield of Milk.—No reliable record is obtainable, but where hand feeding is practised the average yield has been about 1½ gallons per day.

Diseased udders in cows are happily rare, as no case has been recorded for the past five months.

Dairies were found to be in a fairly sanitary condition.

Anthrax.—No case has been recorded.

STOCK AND PASTURES.

Stock are generally in low condition. On the Upper Murray the cattle are, considering the dry season, in fair order, whilst on the Lower Murray many are perishing from starvation, while reports from Delegate state the autumn has been a favorable one. On the South Australian Border the season has been exceptionally dry, and feed is scarcer than usual; and the various reports show that this has been one of the worst seasons on record for graziers.

Native Grasses.—In many cases the best native grasses have been eaten out, and the worst allowed to seed. Overstocking has been the bane of this State, and many of the losses in stock are to be traced to this cause.

Lambing.—The prospects for lambing are not encouraging, and many lambs have already been killed to save the lives of the ewes, but given favorable conditions the percentage losses should decrease among the late lambing ewes.

Breeds of Sheep.—Merino and crossbreds are the principal types.

Dips in use are for the most part carbolic compositions, and, in a few cases, arsenical mixtures.

Artificial Grasses and Fodder.—At Tocumwal principally lucerne is grown, at Swan Hill lucerne, sorghum, and millet, at Delegate barley and rye, at Jinjellic clover, rape, sorghum, rye, and cocksfoot, while at Mildura wheat and barley are cultivated for green fodder. At Tintaldra maize and sorghum, at Koondrook lucerne, amber-cane, and sorghum, and at Gooramadda amber-cane, lucerne, sorghum, couch grass, clover, and rape are grown. Penola reports that *Paspalum dilatatum* thrives well in that district, while Echuca speaks similarly of amber-cane and lucerne. Water is very scarce, many dams and water-holes being dried up, and it is well to note that few artificial grasses are grown along the borders.

IRRIGATION.

Mildura reports that without irrigation there would not be a particle of green food; but in irrigated areas crops of lucerne, wheat, and barley sown in January are now in ear, and 5 feet high. Koondrook reports similarly, *i.e.*, without irrigation there would be no feed, with irrigation amber-cane and lucerne grow well; water is plentiful. At Swan Hill, 15,000 acres comprise the irrigation settlement in this district, the holders of which seem to content themselves with irrigating a little for their own use and growing a crop of hay, which they can rely upon to dispose of during the hot weather. At the irrigation colonies, it is found the proper time to sow lucerne is in August, and amber-cane and sorghum in October.

VERMIN.

Rabbits, hares, dingoes, and foxes are reported as prevalent at Tintaldra. Tocumwal reports foxes are on the increase in that district; hares and rabbits here, as in other parts of the State; and unless stringent measures are adopted to suppress them great loss will be entailed.

Weeds.

In every portion of the State vegetable pests, such as Chinaman, Star, Californian and other thistles, Bathurst burr, Wild Briar, Blackberry, &c., &c., are being allowed to overrun the pastures, and their seeds are scattered broadcast by the winds; unless they are kept in check, landowners will be put to heavy expense in eradicating them; meanwhile they are losing the use of some of the best of the pastures.

Effects of Drought in New South Wales.

Showing the dire havoc among stock in the sister State, during the month of May fodder was exported at Swan Hill alone to relieve starving stock, as under:—

Hay	157 tons	Maize	800 bushels
Straw	12 ,,	Barley	435 ,,
Chaff	523 ,,	Bran	1,871 ,,
Oats	14,373 bushels		

Echuca reports 4,000 tons exported for forage, and 950 tons have been brought to Echuca for feed.

Reports from the South Australian Border state that the number of horses was on the decrease, as the runs are being cut up, and the high prices ruling have tempted owners to dispose of them, sheep and cattle taking their place.

REPORT OF THE INSPECTOR OF FOODS FOR EXPORT.

A. A. Brown, M.B., B.Sc.

General Review of the Trade.

Mutton and Lamb.

During the year 1900 supplies of grass and water were abundant, and stock came into the markets in forward condition, and the London reports on the consignments were of a very favorable character. The prices for stock in Victoria during that year were high, but the high prices prevailing here were counter-balanced by the splendid returns secured in London. Lambs of good quality brought 5¼d., and the lowest grades fetched 3½d. per lb.

The average weight of the lambs shipped that year was about 34 lbs. In 1901, however, through the adverse season, stock came into the markets in backward condition, and, so far as lambs were concerned, they never attained sufficient ripeness before it was necessary to transport them from the pastures to the killing yards. The drought had a very serious effect on the quality of the lambs, and whereas the average weight in 1900 was somewhere about 34 lbs., in September to December, 1901, it had fallen to about 30 lbs. It was found necessary in the last quarter of the year to advise shippers in many instances not to kill and ship lambs of inferior quality, and whenever the advice was tendered it was followed, and the lambs were then put into the yards and disposed of for local trade. Again, a large number of inferior quality, after having been slaughtered, were frozen and shipped to Africa and Western Australia. In no previous season were such poor lambs so generally encountered. High prices were exacted on the pastures, and since uniform prices were paid for all in the lines purchased, exporters had much tribulation in their business transactions, inasmuch as opinions as to quality on the part of their buyers proved very treacherous. At the slaughter-yards the estimated weights of the purchaser were found not to have been realized. To complete the discomfort of exporters the prices in London were not on the high level of 1900, and many who speculated on the basis of realizing such prices have been bitterly disappointed. The best prices at the close of the year were 4¾d. for prime, and 3d. for inferior grades of lambs. The demand at the close of the year does not seem to have been keen, inasmuch as other countries had been able to place large consignments on the London markets, and thus prices, on that account, were materially weakened.

In 1901 freezing accommodation in Melbourne appeared to have been ample. At the close of 1900 the extra space provided at the Government Freezing Works was available for use, and the effect of additional space was seen by the fact that whereas in 1900, 93,658 carcasses of mutton and lamb were handled, in 1901, no less than 134,460 carcasses were dealt with.

Beef, Veal, and Pork.

Trade in frozen beef shrunk considerably below that of 1900, but there occurred a marked increase in the export of veal and pork. A large quantity of the beef exported was brought from Queensland for storage in Victorian Freezing Works prior to shipment. Victoria can never be expected to actually raise large quantities of beef for export. Supplies must be drawn in the main from Queensland. There always exists a brisk local demand for pork, and until producers go into the question of pig-raising on a grand scale there never will be a marked surplus of this commodity for export. For local trade purposes, particularly for conversion into bacon, pigs fetch high prices, and, under existing conditions, our exporters can hardly expect to compete with countries nearer the London markets where pig-raising receives special attention.

Poultry.

The export of poultry during 1901 shows considerable advances on the trade of previous years. There should be no limit to our capabilities in establishing a prodigious trade, as it is within the reach of every one to raise poultry. A little instruction as regards suitability of breeds for table and egg-producing purposes may be necessary; but, so long as birds are properly fed and housed and sanitary conditions fulfilled, not much trouble should be experienced by novices in the industry. It is deplorable to see the wretchedly unwholesome places in which fowls are in many instances housed. The houses are wretched in construction, dark, damp, and ill-ventilated. Fowl-houses should be built upon a definite plan, and should be well lighted by glass windows, and should, moreover, be louvred at each end for a little distance below the wall plates, or auger holes even could be bored in the walls. The louvre work must be above the roosts, so that the air may blow above the birds. So long as the air blows through the building above the birds there can be no danger of their contracting colds. Glass windows are essential additions to every fowl-house. In dark ill-ventilated houses the hen-mite abounds (*Dennanyssus avium*). Not only does the hen-mite delight in darkness, but practically every insect that attacks poultry thrives well under such conditions. Fowl-tick also abhors light, so it is plain that by properly lighting fowl-houses many pests that provoke so much trouble would be kept in check. There should be no industry more profitable to the State than poultry raising, and it is one in which every householder who possesses a little run for birds can embark. Markets exist abroad for illimitable supplies, and by proper attention to breeding, feeding, and hygiene a pecuniarily substantial occupation can be promised to families who would only engage in it perhaps in a small way. In keeping fowls no food material need be allowed to go to waste; all scraps from the table and kitchen could be profitably used up in feeding the birds. It cannot fail to be remarked that evidence is clear enough that many farmers do not sufficiently feed their birds. Birds come into the Melbourne markets in very poor condition, and they consequently fetch

very low prices, whereas if they had been topped off excellent prices would have been obtained, sufficient to pay handsomely for the feeding and extra attention.

Statistics for 1900-1 indicate that in Victoria there were that year 3,620,000 fowls, 76,850 geese, 257,200 ducks, and 209,800 turkeys. The annual value of the industry, according to the Government Statist, was £2,100,000 for the period indicated, and for the year 1897-8 it was estimated at £2,257,000. That it is an industry capable of enormous expansion no one can dispute, and the means to promote it are various in character, and will, perhaps, receive earnest attention in the near future.

Diseases in Poultry.

Fowl-tick has been insiduously spreading in the northern and north-western districts of the State, and legislation has been introduced to cope with the pest. Districts in which it has been found to prevail have been quarantined, and other steps are in contemplation to meet the necessities arising from the invasion of so serious an enemy to our feathered creatures. In districts where fowl-tick prevails no wooden buildings should be employed to house birds, but all such places should be constructed entirely of iron. In iron buildings the tick finds few harbors of concealment, but in wooden buildings every crevice affords them shelter. As it so happens that the tick prevails in very hot districts, some coating of the iron will be required to prevent its getting intolerably hot. A coating of a mixture of one part Portland cement, seven parts lime, and five parts fine sand, made into the consistency of a thin paint, will answer the purpose. This mixture will adhere to the iron, and is fairly weather-proof. The whole inside of the building should be tarred. As the ticks are nocturnal in habit, the roosts should be erected on a frame-work suspended from the roof of the building, and the supports should pass through cups which should be kept filled with formalin or kerosene.

The floors of fowl-houses should be covered with ashes. Ashen floors are warm, and are easily kept clean. Dust baths composed of ashes and pyrethrum powder should be provided on the run. The hen-mite is a widespread pest, and it can only be got rid of by proper attention to sanitary arrangements. "Gapes" was not so common during the year, only a few cases coming under notice. Roup was prevalent, and cases of avian diphtheria, tuberculosis, sarcomata, lipomata, ovarian tumours, cholera, &c., were encountered.

Roosting in trees is the natural condition under which fowls should live. The best trees to grow about poultry yards are the pepper trees (*Schinus molle*), since they will thrive almost anywhere. They make excellent shade by day and serviceable retreats by night. The fowls eat the seeds, which possess stimulant stomachic properties. In no districts do birds thrive so well as in those with light sandy soils. Birds with heavily-feathered legs get on better on sandy soils than on heavy clay soils. On clay soils they are liable to contract scaly leg, a disease caused by a *Sarcoptes*.

Diseases in Pigs.

Pneumonia, tuberculosis, septicæmia, and scouring in pigs were the prominent disorders. All these diseases are caused by germs, and are dependent upon the insanitary conditions under which pigs are compelled to exist.

Construction of Styes.

As a rule the styes are wretchedly deficient in sanitary arrangements. The floors often have been found to consist of logs laid together, or even of hewn timber with interstices between the joints. It is seldom that an impervious floor is seen, and, in consequence of this rude construction, vile-smelling places prevail. In pig-styes it is absolutely essential that the floor be impervious to moisture. There should be a bed of cement, and on this bed bricks set on edge and grouted with cement should be placed. The cement bed should be composed of one part Portland cement, six parts of clean sand, and six parts clean broken stone or gravel. The stone should not exceed 2 inches in any measurement. Mix in the dry state, the sand and cement first, then wet and thoroughly mix in the stone and place the mixture in position, thoroughly tamp, it and make the layer 6 inches thick. On the next day put on a top coat consisting of cement and sand, half-and-half. Trowel thoroughly, and when well set, cover the layer with sand and old sacks and leave it stand for a week or so. When it has completely set the bricks should be laid. The floor should have a fall to drains properly constructed of brick, and the drains should lead into a catchpit with impervious walls.

I have often been consulted as to measures to improve conditions about styes, and have seen on some farms attempts made to render such places sanitary; but they all fail through not paying due attention to the construction of the floors. Until impervious floors are constructed, and until buildings are so erected that sunlight has a chance of penetrating everywhere, pneumonia, tuberculosis, septicæmia, and scours will prevail in pigs. The initial cost of construction would soon be paid for in the value of the animals saved from death by the adoption of the improved sanitation.

Pigs are grazing animals and should have a paddock for a run, and should be watered from troughs and not from water-holes, which they would soon foul. Until they are required to be topped off they do not require special housing except in winter and rainy weather. They must have plenty of shade from the sun in summer, as they are very subject to heat apoplexy, and they must be protected from the cold in inclement seasons, as exposure to cold makes great demands on the animal economy. Animal heat is dependent upon the slow combustion of the foods ingested, and, if the heat of the body be properly conserved by sheltering the animals, there is less waste of tissue in keeping their fire aglow, and consequently less food is required to keep them in healthy condition. Sheltering animals from inclement weather pays. In the case of poorly-fed animals the strain of the exposure may be so great that they are not able to bear it, and they may die

during the night. Deficiency in the amount of food depresses the vital powers, and an ill-fed animal is rendered extremely susceptible to the influence of cold.

Rabbits.

During 1901 coccidiosis and hydatids were not so common as in previous years. I have never yet encountered a case of tuberculosis in rabbits.

Fruit Preservation.

Experiments into fruit preservation were continued during the year, and trial shipments were made to London. The first lot was sent by s.s. *Cuzco*, which left here on 3rd April. The consignment consisted of Josephine de Malines, Glou Morceau and Marie Louise pears, and Muscat, Ladies' Fingers and Red Prince grapes. The temperature in the ship's chambers on the voyage to London is said to have ranged from 38° to 50°. On arrival all the cases of Josephine, and one case of the Glou Morceau pears, were found to be sound. The rest of the pears and grapes were worthless. The sound pears realized 13s. per case.

The second lot was sent by the s.s. *Australia*, which left here 10th April, and consisted of Vicar of Winkfield, Kieffer's Hybrid, Broom Park, and Josephine pears, Gordo Blanco and Doradillo grapes, and some peaches. The grapes and peaches were found to be bad on arrival in London, but the pears arrived in splendid condition. The Josephines brought 21s., Vicar of Winkfield and Broom Park, 17s. 6d., and the Kieffer's Hybrid, 10s. per case. The temperature in the chambers on the voyage is said to have ranged from 38° to 40°.

The third lot was sent by the s.s. *Omrah*, which left here 17th April. The temperature in the chambers on the voyage is said to have ranged from 38° to 46°. The consignment consisted of Vicar of Winkfield, L'Inconnu Josephines, and Broom Park pears, and Doradillo and Gordo Blanco grapes; thirteen cases of the pears, which embraced all the varieties mentioned, arrived in sound condition. Of the grapes only the Doradillos were sound.

The fourth lot were sent by the s.s. *Victoria*, which left here 24th April. The temperature in the ship's chambers is said to have ranged from 43° to 49°. The whole consignment, which consisted of 22 cases of Josephines, Broom Park, L'Inconnu, Beurré d' Anjou, Winter Nelis, Vicar of Winkfield, and Kieffer's Hybrid pears, and nine cases of grapes, Doradillo, Waltham Cross and Gordo Blanco, all reached London in a sound condition. The pears realized from 10s. to 17s. per case, and the grapes from 5s. to 8s. per case.

When we consider what are the causes producing decay in fruits, we are inclined to the belief that something more than careful packing and adjustment of temperature is required to transport soft fruits from Australia to England. The rotting of fruit is dependent upon a cause, and if there was nothing existing in nature to produce this rotting, then fruit would keep indefinitely. Nature's plan is that fruit, to allow of escape of seed, amongst other things, must undergo decay. Investigations conducted into the question lead me to assert that rotting of fruit is effected by parasitic fungi, which either gain the surfaces of the

fruits and make their way thence into the deeper structures from some localized injury, or they may, perhaps, even be incorporated with its structure in the early stages of development, and remain latent there until favorable opportunities for growth occur, as happens after ripening has been effected, or they may find their way into the fruit through a patent opening at the blossom end. In some cases rotting commences at the core, and incorporation of spores during development or invasion through the patent opening at the blossom end explains decay commencing at this seat.

The most common fungus causing decay in fruits is the blue mould (*Penicillium glaucum*), which is familiar to all as a greenish crust on bread, jam, old boots, &c., though several others also assist in the work of destruction.

To effectively destroy these organisms on fruit is not an easy task, and to bring within the range of commercial application some powerful germicide that would not harm the fruit, and yet prove destructive to the micro-organisms, will lead to successful issue in the preservation of fruit. To kill an organism is one thing, to inhibit or suspend its growth and functional activity is quite another. So long as the parasites do not functionate the fruit can suffer no harm, and, even without destroying these low growths, if their development can be arrested for a sufficient length of time we accomplish all we require for commercial purposes.

The action of the micro-parasites is inhibited whilst fruit is green, but when fruit has ripened, their growth, if temperature conditions be favorable, is promoted. The ripening of fruit is a chemical process. During ripening much of the water disappears, while the cellulose, lignine and dextrine are converted into sugar by the action of the oxygen of the air and enzymes or unorganized ferments existing in the substance of the fruit.

As the ripening progresses more and more, the acid constituents combine with the alkaline, and thus acidity diminishes, and sweetness increases. When ripe, fruit forms a good culture media for the fungi that produce decay, the spores of which always exist in the air. Ultimately by the action of these fungi the fruit is reduced to a putrefactive mass.

Cold checks the growth of these low forms of life, but at the temperature suitable for storing fruit moulds can flourish and, in certain varieties of soft fruits, do flourish, and produce decay rather rapidly. In some experiments I trusted almost entirely to methods of packing and the agency of cold dry air kept constantly in circulation at a uniform temperature of 40 degrees Fahrenheit. Various temperatures have been tried and the best results have been achieved, where a uniform temperature of 40 degrees was maintained. In spite of the fact that the air was specially dried by passing it over and though pumicestone saturated with sulphuric acid and caustic potash, and then again over chloride of lime, and kept in constant circulation by means of a fan, moulds, &c., crept in, and in the course of time longer or shorter according to circumstances, brought about the decay of the fruit.

Some varieties of apples, pears, plums, peaches, grapes, and tomatoes can be kept sufficiently long to admit of their exportation to Europe, but something more than cold and careful packing is required to keep soft fruits, like grapes and peaches, in a sound condition for a period, say, of two months. It is not hard to achieve partial success by adopting certain measures, but partial success will not satisfy the requirements of trade. Success must be complete to meet the demands of these exacting times.

In order to make any scheme for preserving fruit in the fresh state a success certain things are really indispensable on board ship.

(1) *A regular temperature.*—The temperature must not sink below 36 degrees, or rise above 40 degrees.

(2) *A constant circulation of cold dry air.*—The air must be dried and kept in motion. The air on board the ships is not properly dried for fruit purposes, and until the companies are brought to recognise its importance shipments of fruit must always be precarious.

(3) *Smaller chambers.*—It would be well if every one could recognise the necessity of having several small chambers in preference to having one large one. In smaller chambers the temperature can be rendered more equable throughout.

(4) *More open stowage.*—The cases should be so stored that air could circulate more freely around them.

(5) On shore the fruit should be carefully selected. No bruised fruit should be exported.

Comparison of Food Exports with Previous Years.

Frozen Mutton and Lamb.

During the year 246,619 carcasses of mutton and lamb were exported from the Newport, Government, and other metropolitan cool stores, and in addition about 112,849 carcasses were shipped from the Hamilton, Geelong, and Portland Freezing Works. In the previous season 257,432 carcasses were exported, and 307,065 in 1899 from the metropolitan works.

Frozen Beef, Veal, Pork, etc.

During the past year 8,670 quarters of beef, 2,325 carcasses of veal, 1,803 carcasses of pork, 103,904 head of poultry, 1,302 cases of mutton and beef sundries, 368 cases of frozen cod fish, and 25 barrels of sausage casings were exported from the various works.

In the previous year 19,248 quarters of beef, 2,062 carcasses of veal, 1,380 carcasses of pork, 38,846 head and 380 crates of poultry; and 640 quarters of beef, 369 carcasses of veal, and 17 carcasses of pork were sent from the State in 1899.

Frozen Rabbits and Hares.

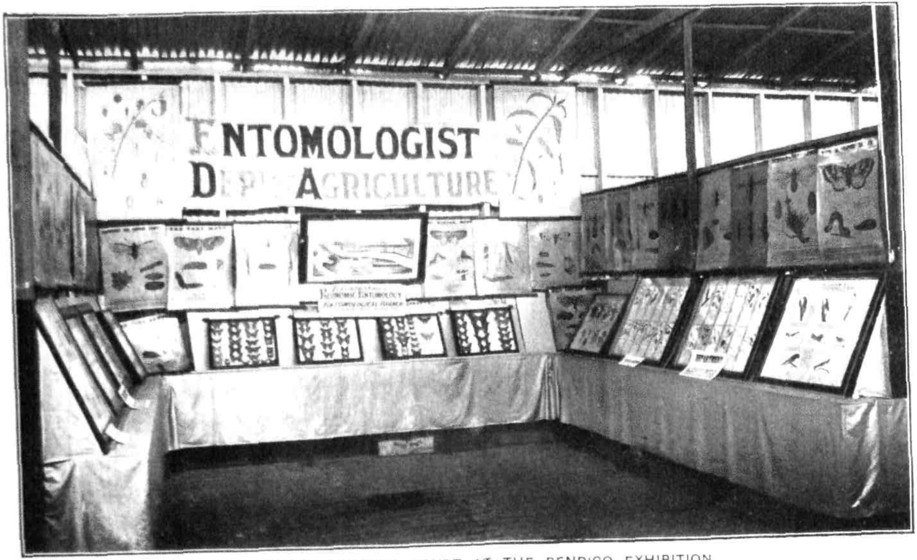
This season 2,157,112 pairs of rabbits and 1,944 brace of hares were frozen for export at the Government, Portland, and Hamilton Freezing Works, as against 2,086,352 pairs of rabbits and 176 brace of hares exported from the Government works in the previous year.

Canned Meats.

During the year 3,089,360 lbs. of canned rabbits, 161 cases of canned hare, 1,091 cases of canned poultry, and 1,245,094 lbs. of canned beef and mutton were packed for export. Of this, 1,101,806 lbs. of the canned beef and mutton were exported to South Africa to meet War-office orders. In 1900 there were 2,035,864 lbs. of canned beef and mutton and 2,168,992 lbs. of canned rabbit exported.

Jams, Canned Fruits, and Vegetables.

In 1901 I inspected 934,536 lbs. of jam, of which 930,864 lbs., consisting of plum, apricot, and gooseberry, were shipped to South Africa on account of War-office requirements. I also examined 157 cases of canned fruits and 10 cases of canned vegetables. In 1900 1,500,000 lbs. of jam were exported.



THE ENTOMOLOGIST'S COURT AT THE BENDIGO EXHIBITION.

REPORT OF THE ENTOMOLOGIST.

C. French, F.L.S., F.R.H.S.

During the past year the work of examining and reporting upon specimens forwarded to me has largely increased, and thus a large proportion of my time has been taken up in this way.

Reports on a variety of subjects, including the Codlin Moth, Sparrow tests, Grass-feeding Caterpillars, Spraying small gardens, Fruit imports and exports, have been furnished, besides others to the Education and Forests Departments, Press, &c.

Correspondence.

This work is increasing considerably; much of it necessitating a personal reply, and only those who have to perform similar duties will be able to appreciate the time and trouble entailed by a correspondence dealing with difficult subjects often requiring careful and lengthy examination. I have here to acknowledge the help furnished by my Assistant; the total number of letters replied to and entered in the letter-book being 2,779, as against 2,482 for 1900. In correspondence such as this, it is often necessary to give advice as to preventive and remedial measures, and when I am in Melbourne a prompt reply is always forwarded. When I am away upon departmental business my letters are sent on to me daily by my Assistant, so that in evening hours I can reply to these, and am thus enabled, in a great measure at least, to keep pace with the most important of the correspondence.

Publications.

The issue of Part III. of the *Handbook of the Destructive Insects of Victoria* has been followed by a desire on the part of the rural public to see Part IV.; but, owing to great pressure of work and a deal of travelling, I have been unable to do much towards the MS., although the coloured plates are now ready. It is a matter for congratulation, I think, that Part III. is still in good demand. An illustrated pamphlet dealing with the Water-Hyacinth has been ordered by the Minister, and as the New South Wales Department of Agriculture has kindly placed blocks at my disposal, I hope to secure the publication of this as soon as possible.

Investigations and Experiments.

Under this heading it may be observed that much has been done in a quiet way with the San José Scale, Root-Borer, Codlin Moth, Caterpillars on pastures, Crickets, &c.

The *Locust fungus* introduced from the Cape has proved very successful against grasshoppers, especially in the cooler and more mountainous parts of our State; no less than 400 applications for the fungus having been made by graziers and others. Requests to be supplied with this valuable remedy against that terrible pest, the Grasshopper, have also been received from Queensland, New South Wales,

Tasmania, and from the furthermost parts of Western Australia. The Locust fungus, which has acted so splendidly in Cape Colony and other places against the above-mentioned scourge of humanity, may now be had on application, the tubes containing the fungus having been prepared by Dr. Cherry at the University laboratory. These are sent to all who require them, each package being accompanied by printed instructions for use. It may be mentioned that quite a large number of letters have been received by the rural press and by myself, testifying to the great success which has attended these experiments instituted by me for destroying the Grasshoppers. Some of the graziers in Gippsland have themselves prepared cultures of this fungus from the dead bodies of infected grasshoppers, so that if this success continues, one of the very worst pests known to farmers will have been brought under control.

The *San José Scale* continues to be troublesome; and, in a nursery at Kyabram, in the north-east part of the State, the Department was compelled, for the safety of other growers, to order the destruction of nearly the whole stock. It is to be hoped that by diligent attention, and when necessary taking drastic measures, we may be able, not only to prevent the spreading of this pest, but to stamp it out altogether.

The injurious weed, *St. John's Wort*, continues to spread, the total area roughly estimated as being infested being 10,000 acres. The *Stink-Wort* and other introduced noxious weeds are also making great headway, and although not belonging to my branch, I have been requested to report upon some of these which, if not promptly dealt with, will soon devastate some of the best portions of our State.

The *Codlin Moth* pest, owing, doubtless, to the abnormally favorable season for most insect-life, continues to cause grave trouble; some valuable experiments having been made by the Inspectors in several orchards throughout the State, and these, together with other matters bearing upon this scourge of the fruit-grower, will be published with illustrations in pamphlet form for the purpose of distributing the same broadcast amongst growers.

That serious pest of the growers, the *Apple root-borer*, also continues to cause orchardists much apprehension and trouble, as when a tree is once badly attacked there is but small hope of its ultimate recovery. It will be known to many that a proposal has been made by certain Fruit-growers' Associations that a substantial reward be offered for the best means of coping with this pest, and that the Department has been asked to supplement the amount offered by the growers. The Minister has promised, not only his best consideration of these suggestions, but has also appointed a committee to deal with the matter.

The gradual but sure crumbling away of the banks and cliffs of our sea shores still continues; and although attention was in my last report drawn to this most important subject, nothing has so far been done, although a little judicious planting might have assisted in arresting this trouble, which in a few years bids fair to undermine the tramway line between Sandringham and Beaumaris. It is hoped that this matter will be dealt with ere it is too late.

Fumigation.

Some trials with our new fumigating tent has been made in various parts of the State, the citrus trees treated now being clear of scale, and the results, upon the whole, most satisfactory. Any orchardist requiring the use of the tent, which will treat a tree 16 feet high, should apply to the Secretary for Agriculture, Public Offices, Melbourne.

The following information is contained in the valuable report of Mr. Fuller, Government Entomologist, Natal.

Cyanide of potassium and sulphuric acid are highly poisonous chemicals, and should be kept under lock and key, and placed in some dry place and labelled "Poison."

The poisonous action of cyanide and hydrocyanic gas is the same ; a mere taste of one or a breath of the other will probably prove fatal.

Hands and nails must be cleaned after using to avoid taking cyanide into the system later when eating.

Sulphuric acid or oil of vitriol burns almost anything it comes in contact with, and when diluted with water will burn the hands, clothes, and covers.

Cyanide decomposes rapidly if left exposed to the moisture of the atmosphere. It must, therefore, be kept in air-tight boxes or tins.

Instructions how to Use the Tents.

In the event of the cyanide-gas process becoming more general in our State, the following simple instructions for using same may be found useful to growers and others.

The cyanide-gas treatment is more suitable for the treatment of citrus than deciduous trees as apples, pears, peaches, &c.

The gas is prepared by using—

Cyanide of Potassium, 90 % ...	1 oz.
Commercial Sulphuric Acid ...	1 fluid oz.
Water	3 fluid oz.

The water is first placed in an open glazed vessel, and then the acid is added. When the parts to be treated are all covered, the diluted acid is placed under the tent, the cyanide of potassium is dropped in, and the tent immediately closed. The gas is exceedingly poisonous, and should not be inhaled. The amount formed with the above material is sufficient for a confined space containing 150 cubic feet.

The tent for large trees should be made of No. 10 American duck canvas, and No. 8 for the smaller ones. If tents are to last in a climate like Australia, they must be made of canvas which should be oiled and thoroughly dried before putting away. This latter is a most important matter, as if the oil be not sufficiently dried into the canvas spontaneous combustion is likely to occur. In adopting the cyanide process, it should be remembered that if it can possibly be avoided the trees should not be treated on bright hot days, nor when the foliage is wet, as they are likely to be injured both by a high temperature and by excessive moisture.

In America, the work of cyaniding the orchards is done mostly at night, several tents being, of course, necessary for treating trees on large areas, as otherwise part of the staff would be waiting, and thus losing much time.

If a tree be badly affected, the tent should remain closed for about one hour, but this and other matters concerning the process must be left partly to the intelligence of the operator in charge. In small gardens covers made of ordinary sheeting will suffice, but this must also be well oiled to prevent the gas escaping.

That the cyanide-gas treatment for orchards has been most successful is beyond doubt, the process being both cheap and effective. Before placing the cyanide in the basin, care should be taken that the tent is well covered up at the base with soil, leaving only a small aperture through which to introduce the cyanide. When the operator is about to introduce the cyanide, a man should be ready with a spade, and the cyanide slipped in quickly, the operator being careful not to inhale the fumes in the slightest degree. When raising the tent do not, as some persons advise, remove the basin before lifting the canvas, but stand off and haul up the cover—vertically, if a large bell tent—and, after a few minutes, the plate can be removed, and the contents buried in the soil. Persons requiring fuller instructions as to the use of the cyanide-gas tents may obtain same upon application to myself.

It is intended to publish fuller particulars in pamphlet form, so that growers may be able to find out all about this useful and modern process.

Museum of Economic Entomology and Ornithology.

The excellent practice of amalgamating these two useful and highly interesting branches originated in the United States of America; and, being followed by us, has in many ways proved the value of the two subjects, when in combination, for the assistance of the growers.

Since my last report I have to announce many valuable additions, especially to the life-history work, so useful to those who take an interest in the study of such matters, many strange insects almost if not quite unknown to growers having made their appearance, and have been described by specialists in the various orders or groups to which the insects belong. I have to thank Mr. T. G. Sloane, Mr. W. W. Froggatt, Mr. Tryon, Mr. E. E. Green, Dr. Goding, the Rev. T. Blackburn, and others for valuable help in this connexion. The museum is to the entomologist what the laboratory is to the chemist, the pathological museum to the surgeon, and the herbarium to the botanist. In speaking of the additions which have been made to the collections, I may mention a number of life histories from my Assistant, from myself, and from inter-State contributors, also by exchanges, and in a few instances by purchase. The collection of the Victorian insect-destroying birds is well nigh complete, the whole furnishing a fine field for reference, and a valuable asset to the rural public and to the State.

Library.

The valuable collection of books has been added to since my last report, especially by the great number of pamphlets and reports kindly sent by the various Entomological branches of the Agricultural departments of the United States and elsewhere. The death of that talented entomologist, Miss Ormerod, has left a blank in the literature of Economic Entomology which will be difficult to fill, and her fellow-workers generally will severely miss the valuable contributions from her pen, always so cheerfully and freely circulated.

The library contains about 1,000 bound volumes, numbers of periodicals, pamphlets, &c., being both large, representative, and valuable, a catalogue of the whole library being in course of preparation.

The Vegetation Diseases Act.

Inspection of Orchards, Nurseries, and Gardens.

The supervision of this large and important work still devolves upon myself, and the inspection so far as it has gone has proved satisfactory. It is certain, however, that there are too few inspectors to enable full justice being done towards a proper interpretation of the Act. Of late, two additional inspectors have been appointed, one of these having to attempt the control of the whole country from Cape Otway to Mildura, the latter included ; the other the Goulburn Valley district, where there are miles of orchards. Growers will be pleased to hear that two additional inspectors have been applied for, thus making available nine inspectors altogether. It is to be hoped that with the increased number better and more systematic work may obtain. Up to date, over 6,000 orchards and places have been visited, and full instructions given by the inspectors in charge of the various districts. We have also had to prosecute many careless growers, who, rather than comply with the regulations or assist in the work, have preferred to grub out their trees. The Vegetation Diseases Act was brought in to assist growers, not to persecute them, and it is in this spirit that the inspectors are instructed to act as far as possible.

Inspection of nurseries, both in the city and country continues to work satisfactorily, a marked improvement in the stock, especially of the smaller places being most noticeable, one pleasing feature being the willingness of the owners to comply with the regulations.

The removal of the prohibition of imports into Tasmania of Victorian plants has been the cause of a large extension of our trade. Every care is being taken by our growers not to forfeit the confidence of the authorities of the sister State, or to cause any regret at the removal of the restrictions formerly so irksome. The number of certificates issued to clean nurseries from this office was 1,519, as against 1,456 of the previous year. These certificates represent a total of 1,582 bundles of fruit-trees, cases of plants, &c., sent out of this State for the year.

Great difficulty is still found in any attempt to deal effectively with the enormous number of small gardens, a large majority of which contain a few trees of some kind, thereby keeping up a continuous line of

communication for diseases all and sundry. As it would be impossible for an inspector to visit the whole of these suburban and country places, a suggestion has been made to the effect that certified persons qualified in the use of spraying, &c., might be employed to keep these small places free from pests, the treatment, of course, to be approved by the officers of the Department.

Year by year the orchards abandoned at the land-boom period are becoming less, buildings often taking the places of neglected and disease-bearing trees. This is a matter for congratulation, these plague spots having given endless trouble and annoyance, it being in many cases most difficult to trace the responsible owners.

Spraying has now assumed proportions which were a few years ago, in Victoria at least but little dreamt of, and instead of the one solitary sprayer, Spawn's, which then was the only one in our State, thousands of similar appliances, ranging from the Knapsack, so well known to European vignerons, to the powerful machines so much in demand for large holdings, are now commonly to be seen. In America, the steam spraying machines, as in the case of ploughs, are rapidly superseding all others where large orchards have to be treated, a good spraying outfit in that go-ahead country being almost as necessary in an orchard as the plough to a farmer.

In my former report I alluded to an Amending Vegetation Diseases Act having been circulated; this has now become law, and, although stringent, it was necessary, especially for the protection of the careful growers from the careless and unthinking. The various diseases therein proclaimed are enumerated here.

INSECTS.

Acarid ("*Maori*" *on Citrus Fruits*),
Aspidiotus rossi (Black flat Scale),
Aspidiotus coccineus (Red or Orange Scale),
Aspidiotus perniciosus (San José Scale),
Caecœcia responsana (Light-brown Apple Moth),
Carpocapsa pomonella (Codlin Moth),
Chionaspis citri (White Scale of Orange),
Chionaspis eugeniæ (White Mussel Scale),
Halterophora capitata (European Fruit Fly),
Leptops hopei (Apple-root Borer),
Lecanium oleæ (Olive Scale),
Mytilaspis pomorum (Apple-bark or Mussel Scale),
Mytilaspis citricola (Lemon Leaf and Peel Scale),
Myzus cerasi (Black Peach Aphis),
Phylloxera vastatrix (Vine Louse),
Selandria cerasi (Pear Slug),
Tephritis tryoni (Australian Fruit Fly).

FUNGI.

Fusicladium dendriticum (Apple Scab),
Fusicladium pyrinum (Pear Scab),
Phyllosticta circumscissa (Shot-hole of Apricot),
Exoascus deformans (Leaf Curl of the Peach),
Phoma citricarpa (Anthracnose or Black Spot of the Orange and Lemon),
Cladosporium carpophilum (Peach Freckle),
Puccinia pruni (Prune Rust),
"*Metanose.*"

Inspection of Fruit for Export.

The work of fruit inspection is gradually increasing, and there is every prospect that it will continue to be a check upon both careless and inconsiderate shippers. To facilitate this work a temporary office has been secured for Inspector Turner in a suitable part of the city in close proximity to both markets and wharves. A tabulated statement compiled by this Inspector, to whom I have delegated the temporary supervision of this class of work, is attached.

I must again refer to the crude and unbusinesslike methods of fruit inspection at the piers. The cases are dumped down in all weathers, often in a storm of wind and rain, and have to be opened for the examination of the fruit, then the wet wrappers are replaced, and the cases fastened up again, the marvel being that the fruit ever reaches Europe in good condition. I strongly recommend the erection of some suitable shelter for this work, a matter which should be seen to before next export season, as it is one of great urgency, and will not admit of further delay.

REPORT OF INSPECTOR TURNER.

The inspection of fruit imported into and exported from the State of Victoria has, during the last three years, developed into one of the busiest branches of the Department. The removal of the Inter-State duties has enormously added to the trade; for instance, during the Cup week of 1900, we received from New South Wales 4,823 cases of oranges; during the same week of 1901 we imported from that State no less than 22,670 cases—an increase of 17,847 cases. One satisfactory feature shown by the returns furnished is the steady growth of the export trade, not only with the other States, but with England, South Africa, and other ports. It has been clearly proved that, with a reasonable amount of care, our harder fruits will carry to the antipodes with safety and profit. Last season was the busiest yet experienced, and although in some cases the returns show a falling-off, these are more than counterbalanced by the large increase in other lines. Soft fruits, such as cherries, raspberries, &c., are now carried by rail without a preliminary inspection at this end, hence the apparent falling-off in the returns of those fruits. Bananas, again, have fallen heavily. The Chinese agents inform me that this, at one season of the past year, was due to the floods in Queensland ruining many of the plantations, and also to the low prices concurrent with the heavy local production of other fruits in the first half-year of 1901.

It will be seen that there has been a great decrease in the amount of fruit condemned during the year. During the previous seasons many steamers arrived loaded with bananas which turned out to be rotten and diseased. These were promptly condemned in huge heaps of four or five thousand bunches, and, of course, the list of condemned fruit was swelled accordingly. This did not occur last season. Formerly the Italian fruits were dumped into this State regardless of the fact that they were smothered with disease. That happily is almost a thing of the past. Very little now arrives but the very best. The bananas, too, formerly came here in large quantities infested with fruit fly; but, by arrangement with the Queensland inspectors this has been reduced to a minimum.

It is gratifying to note the large increase in our apple and pear exports to the other States, as shown hereunder :—

Fruit	1900.		Increase over 1900.
Apples	5,781 cases	19,974 cases	14,193 cases
Pears	32,900 ,,	69,440 ,,	36,540 ,,
Totals	38,681 ,,	89,414 ,,	50,733 ,,

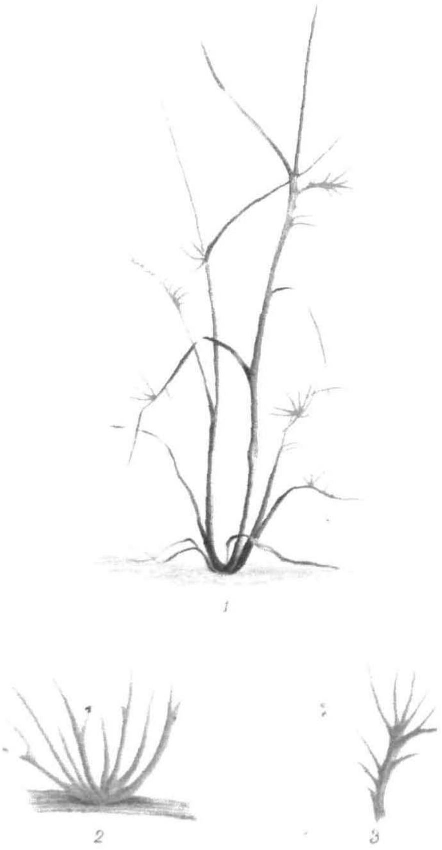
With the produce of our young orchards constantly coming into the field and adding their quota to the year's output, the work of this branch of the Department is likely to continue to expand.

Conclusion.

It is pleasant to note that so far as we are aware neither of the two much dreaded fruit-flies have as yet obtained a foothold in our State. This not only shows the soundness of our system of fruit inspection, but is most gratifying to the Victorian grower that these two pests are not added to his many troubles. No pains will be spared to prevent, if at all possible, these ,insects from landing in our State, but should such a calamity happen they will be fought continuously, and we trust effectually. The fruit-fly is such a serious pest that if we can manage to exclude it by a system of rigid inspection it will be a matter for all-round congratulations, and a good example of money well spent.

It is also satisfactory to be able to state that so far very little friction between the inspectors and the public has taken place. I have again to express my appreciation of the work of the inspectors as well as of the valuable assistance of the Customs department without which the work of our inspectors would have been considerably increased and thus rendered more difficult.

In conclusion, I can only hope that some different arrangements with regard to my duties may enable me to take a more active part in field work, and investigations which has long been necessary, and of the greatest importance to growers. I have also to thank those who have contributed to the library, collections, &c., and the various inspectors for many notes of interest.



ISARIA ON GRASS.

1. Natural size, showing tufts.——2 and 3. Tufts slightly magnified.

REPORT OF THE VEGETABLE PATHOLOGIST.

D. McAlpine.

There has been as usual a great variety of plant diseases requiring attention, and the nature of the season has been such as to favour in many instances the development and spread of those fungus growths which are generally so destructive in their effects. The Black Spot of the apple and pear is a case in point, but at the same time it is gratifying to note that this dreaded disease, like so many others, has been completely kept in check and overcome by the methods recommended by the Department, and proved experimentally in a number of orchards.

As showing how much the services of this branch are called into requisition it may be mentioned that over 800 specimens were sent in for determination, and most of these involved microscopic examination, and often prolonged investigation to settle their true nature. Lectures have also been delivered on various diseases, and publications relating to the more prevalent maladies have been issued, the best-known methods of treatment always being given.

Now that there is an *Agricultural Journal* issued by the Department, in which from month to month seasonable articles are furnished by the various officers, and full reports given of the investigations and experimental work carried out, together with the practical results obtained, there is no occasion to enter into detail here, but simply to review the work already accomplished, and to give some indications of what is at present under way.

Field experiments have been a special feature of the year's work, although they have been conducted to a greater or less extent previously. A summary of the work done may be given under the following headings :—

I. Experiments.	III. Publications.
II. Museum and Herbarium.	IV. Miscellaneous.

I.—EXPERIMENTS.

Rust in Wheat.

The past season was favorable to the appearance of rust, and there was a good deal of it in different districts, most of the varieties grown in the Port Fairy experimental plots being badly affected, thus permitting of rust-resistant varieties being selected for further trial. Advantage was taken of this prevalence of rust to determine the proportion between Spring and Summer rust in 76 plots of wheat, and it was clear from this study that the only rust of economic importance in Victoria, that is, the one which reduces the yield, is the Summer rust (*Puccinia graminis*). As far as rust-resistance is concerned, Rerraf, one of Farrer's crosses, is perhaps the

most valuable, and in addition to being clean and an excellent hay wheat, it is early, holds the grain well, and yielded 40 bushels per acre of plump grain at Port Fairy.

There is one phase of the rust question which has still to be determined for Australia, and that is, how does the rust fungus *survive from year to year, and on what plants, if any?* It has been found that the summer spores, or uredospores of the rust as they are called, can retain their vitality during our comparatively mild winters, and re-infect the young growth of wheat in the Spring; but the Winter spores, or teleutospores as they are called (and sometimes black rust), are also produced here, and the question is—what becomes of them and what part do they play in propagating the rust? This so-called black rust is very common in rusty seasons on the stubble, *and it is surmised that the spores may pass from that to the next* season's crop. In Britain this stage of the rust infects the Barberry bush, but it has not been found to do so here, and even Dr. Plowright, the eminent English authority on Rusts, has failed with specimens sent from Australia, although, as he says, he never failed with the English form. So he has come to the conclusion that we have not got the true Barberry-Wheat Puccinia.

Variety Tests of Wheat, Oats, and Barley.

This testing of varieties has naturally grown out of the Rust-in-wheat experiments. Since it is now generally recognised that the clue to success in combating the rust lies in the relative susceptibility of the different varieties of wheat, a number were grown alongside of each other, obtained from different parts of Australia as well as from foreign countries. While selecting varieties primarily for their *liability or resistance to rust, other good qualities were not overlooked,* and so at the same time wheats suitable for particular districts were discovered, either with or without rust-resisting qualities. And here I cannot pay too high a tribute of praise to the Wheat Experimentalist of New South Wales, Mr. Farrer, who has laboriously and enthusiastically carried on for a number of years a system of crossing, whereby not only in the different States but in other parts of the world, new cross-breds have been provided to take the place of the old varieties. Year after year he has generously provided me with a number of his best crosses adapted to Australian conditions, and the result has been that some new wheats of superior merit and suitability have been introduced into the State. I may merely mention Queen's Jubilee, Rerraf, and Outpost, though there are many others of considerable value. While a number of farmers in different districts have tried these selected wheats on a small scale, a definite series of experiments were begun in 1899 for three years in the Mallee at the instance of Mr. Taverner, then Minister of Agriculture, and the results have even exceeded expectations. Latterly, not less than one acre of each variety was sown in order to give a fair idea of its suitability for the district and its average yield. One of the farmers writes:—"I am aware the three years

have expired, and I feel satisfied that the experimenting with different sorts of wheat has done a lot of good, and the farmers see there is something in getting hold of a new wheat. Jubilee is now grown all over this district, and although somewhat rusty, they are all giving it another trial in the hope that they will get a big average. Hudson's Early is a good wheat, also Improved Allora Spring." Another writes enthusiastically as follows:—"When a farmer can see with his own eyes a 28-bushel crop growing in the midst of a 5-bushel district, he has usually some questions to ask, and even if he does not quite accept the answers, he is apt to revolve the whole matter in his own mind with good results."

Eleven different varieties of oats from Dookie College were tried at Port Fairy, and only Algerian and Skinless Oat were found suited to the district, the others being too late.

As regards barleys, ten varieties were sown at Port Fairy and their malting qualities were kindly reported on by Mr. Barrett. Only three were retained and all originally came from the Woburn Experimental Farm, England, viz.:—Hallett's Pedigree, Californian Chevalier, and Chevalier.

Stinking Smut or Bunt.

There are several chemical substances known to prevent the germination of the Bunt spores, and the object of these experiments was to determine the cheapest, most effective, and the one least injurious to the grain of the three principal substances, bluestone, corrosive sublimate, and formalin. One thousand grains of the same variety of wheat were taken for each treatment and thoroughly dusted with the bunt spores, and an untreated plot was also sown with seed infected in the same way. The result showed that while 95 per cent. of the plants in the untreated plot were bunted the others were quite free, but 96 per cent. of the seed germinated in the former, and the highest percentage of germination in the latter was 71. The cheapest treatment was that of the formalin, 1 lb. to 100 gallons of water, in which the seed was soaked for ten minutes and then sown after drying. It is interesting to observe that Mr. Farrer, who has already succeeded in producing many valuable cross-breds, some rust-resistant and others drought-resistant, is now endeavouring to supply us with a bunt-resisting wheat. By the ingenious device of infecting with bunt the seed which produces the variable generation of new cross-breds, he hopes to be able to select those plants from the new generation which are bunt-free, and thus propagate a strain which may prove less susceptible.

Black Spot of Apple and Pear.

(Fusicladium.)

The past season was one of the worst for the development of this disease, and, therefore, the various sprays used for keeping it in check were put to a severe test. Fortunately an extensive series of experiments were carried out both by orchardists themselves and by the Department, and the results showed conclusively that even in a bad spotting season, all the fruit on sprayed trees may be marketable and

even over 90 per cent. of absolutely clean fruit obtained. Since a full account of the experiments, the fungus causing the disease, and the best methods of applying the sprays, have already appeared in the *Journal*, it will not be necessary to enlarge here.

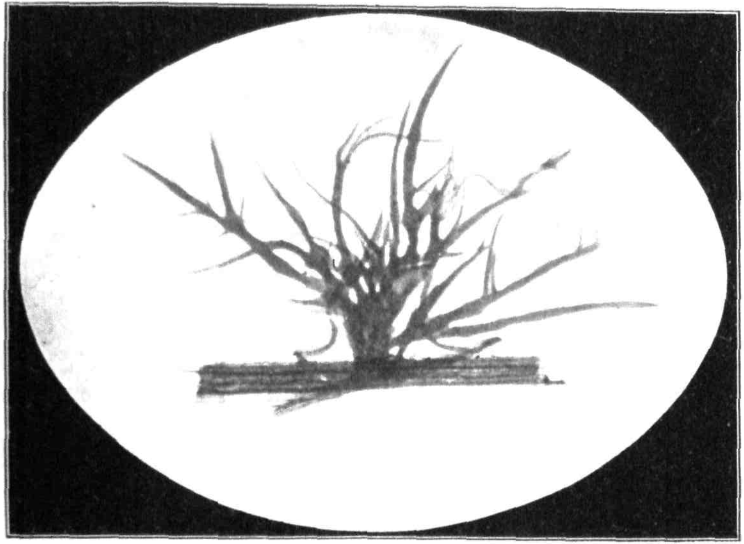
The great feature of the season's experiments was that the well-known Bordeaux Mixture applied *once* at the right time and uniformly distributed in a fine spray was an efficient preventive of the disease. Also that by means of various simple and inexpensive additions to the Bordeaux Mixture, its efficiency was so increased that almost perfect results were obtained, that is, all the fruit was not merely marketable, but very little of it showed even a speck of the fungus. The form of Bordeaux Mixture found to be cheapest and most effective on the whole consisted of 6 lbs. bluestone, 4 lbs. quicklime to 50 gallons of water (6.4.50), as it yielded 100 per cent. of marketable fruit. Certain additions to the plain Bordeaux showed a decided advantage, and this was very noticeable in the sprays used by Mr. Grant and Mr. Hatfield at Pakenham. In our own experiments the addition of salt and sal-ammoniac was decidedly beneficial in increasing the percentage of spotless fruit, 67 per cent., while one of Mr. Grant's mixtures yielded as high as 94 per cent., and Mr. Hatfield's mixture 83 and 98 per cent. of clean fruit.

The best time for spraying appeared to be just when the blossom-buds were bursting, the spores of the fungus beginning then to put forth their delicate germ-tubes which had not as yet penetrated the tissues. Experiments will be continued during the forthcoming season to determine the relative effect of sprays applied at different times, the strength of Bordeaux Mixture most beneficial, and the various substances that may be added to Bordeaux with advantage, such as sulphate of ammonia, nitrate of soda, and nitrate of potash or saltpetre.

There is another preparation which will likewise receive further attention since it gave very promising results, viz., Copper-soda mixture in which the lime of the Bordeaux mixture is replaced by washing soda. It has many points in its favour—it is very easily prepared, it resists the action of rain better than lime mixtures, is free from all gritty matter, and therefore eminently suitable for spraying, and it should prove a great boon to fruit-growers in districts where good fresh lime is not easily obtainable.

Crinkle and Bitter Pit of the Apple.

In view of the many serious complaints during the last few years regarding the prevalence of the Bitter Pit and Crinkle in apples, it was decided to conduct a comprehensive series of experiments with manures to test their effect upon these diseases, and the results obtained will be given in a future issue of the *Journal*. It was specially desired to find a method of combating the Bitter Pit since some of our most valuable apples are particularly subject to it, such as Jonathan, Cleopatra, Scarlet Nonpareil, and Esopus Spitzenberg; and in addition this obscure malady is often confounded with the Black Spot. It has even been asserted in the press that the latter, Black Spot, develops on



G. H. Robinson, Photo.

Fig. 4.—Isaria on Stem of Grass. × 10.

perfectly clean sound apples after being stored. No proof whatever has been advanced in support of this contention, and it is to say the least, highly improbable from the scientific aspect that such a thing should occur. Experienced growers, well conversant with both diseases are emphatic in declaring this notion to be unfounded.

A Word of Warning.—I wish to again draw attention to the numerous complaints received from London regarding the presence of brown dry spots, sometimes incorrectly referred to as Black Spot, on Australian and especially Tasmanian apples. These spots are unquestionably due to the Bitter Pit. When shipping any variety liable to this disease the fruit should be picked and laid aside for at least a week before packing. Even in this short period the great majority of the apples likely to be affected can be separated from the sound ones, and on no account should they be exported. Such fruits get worse the longer they are kept, and specimens only slightly pitted when shipped on arrival in London are so unsightly as to considerably reduce the value of the whole consignment.

Grass-destroying Fungus.

(*Isaria graminiperda.*)

In my Report for 1900, the effect of various manures on this fungus was given, and it was shown that nitrogenous manures were the most effective, the plot on which sulphate of ammonia was applied being the most satisfactory of all.

During the past season, sulphate of ammonia and nitrate of soda, both singly and in combination, were used on 1-acre and ½-acre plots in various proportions, with the results shown in the following Table :—

Plot.	Manure.	Lbs. per acre.	Area.	Remarks.
1	Sulphate of Ammonia ...	28	1 acre ...	Applied 20th August on hill, side facing south. Good results, very marked, showing effect in ten days.
2	Sulphate of Ammonia ... Nitrate of Soda ...	12 12	1 ,, ...	Applied 21st August on top of hill. Fairly good, but not so marked as Plot 1.
3	Nitrate of Soda ...	32	,, ...	Applied 23rd August on top of hill Ver, good, much better than mixed manure, and showing more growth.
4	Sulphate of Ammonia ...	36	½ ,, ...	Applied 23rd August. Splendid growth for a time, but gradually withering off.

No *Isaria* occurred on any of the Plots.

The soil in each plot was of good quality and fairly equal, so that the results are quite comparable. The first plot was undoubtedly the best, and shows that sulphate of ammonia applied at the rate of ¼ cwt per acre, costing only about 2s. 6d., is an effectual means of getting rid of this fungus.

On the untreated portions the fungus was plentiful, and did a considerable amount of damage to the grass. At present (June) the *Isaria* is beginning to re-appear on the unmanured portions, but there is not the least sign of it on the manured, and the question has still to be settled how long the effect of the manure lasts in warding off the fungus; where the sulphate of ammonia was used two years ago there is no sign of the fungus as yet. The manured portion can be easily distinguished from the unmanured by the richness of the growth and the darker green of the grass, and it was eaten down by the cattle to such an extent that the grass at the boundary was left untouched and stood up like a wall. The increased yield and the succulence of the grass were so marked that it pays to manure, even apart altogether from its effect on *Isaria*.

My best thanks are due to the Messrs. Brittlebank, Myrniong, for having carried out the experiments under my direction towards the eradication of the grass-destroying fungus, and for having brought them to such a successful issue.

Tobacco Mould.

This serious disease of the tobacco plant has been referred to in previous Reports, and attention will be confined here to the best means of prevention, as shown experimentally in 1901. This is the third year of continuous experimenting, but there was little or no mould the two previous years, so that no definite results were obtained.

In 1899, 40 seed beds were laid out, and a large number of different methods tried. All the plants that did grow were very healthy and no mould appeared. Generally speaking, the plants in the burnt beds were better than those in the unburnt beds.

The experiments were continued in 1900, and it was again observed that the burnt beds had the advantage, growing more freely and comparatively free from weeds as compared with the unburnt beds.

In 1901, twenty seed beds were laid out, and two other large plots covered and uncovered.

The beds were sown on 23rd August, and the treatment was applied two or three days before.

Since a full account of these successful experiments will appear in a future issue of this *Journal* it may briefly be stated here that Bordeaux Mixture gave the best results. The strength used was 1 lb. bluestone and 1 lb. lime, to 10 gallons of water (1.1.10), and all the beds so treated were free from mould, while all the beds untreated had more or less of the disease. Double this strength of Bordeaux was likewise tried (1.1.5) and there was no mould, but it evidently acted injuriously on the seed, for the germination was rather defective. There is no doubt that Bordeaux Mixture applied to the seed beds before sowing is a preventive of the mould, and this season all the beds on the Government farm, Edi, will be so treated with the exception of a few reserved as checks.

The Hop Industry.

A number of sets of the best varieties of hops were imported from England in 1900, and those that survived the journey were placed in the hands of Mr. Henry Boyce, of the Deepdene Nursery, Balwyn. A fair proportion became available last spring and were distributed to growers in the various districts. The work required in the future to improve the position of the industry lies entirely in the hands of others. Dr. Howell, it is understood, will pay attention to the soils and manures required, besides investigating the chemical composition of the hops produced, and testing their suitability and value for brewing.

II.—HERBARIUM AND MUSEUM.

A considerable number of species both new and old have been added to the Herbarium during the past year, and efforts made to secure a thoroughly representative collection of Australian parasitic fungi. A goodly number of the more conspicuous specimens, especially those on fruits, have been preserved with spirit in glass jars and were shown at the recent Bendigo exhibition. Some of the more common parasitic enemies of crops, trees, and vines were mounted on card in show cases for the same occasion. These form a valuable means of acquainting those interested with their general appearance under natural conditions. Unfortunately, lack of time and opportunity prevents much being done in this direction.

In examining the diseased specimens sent in for identification and report, microscopic preparations have usually to be made, and these are preserved in suitable cabinets for future reference. There is already an extensive collection of such microscopic slides, showing the minute structure and spores of the various parasitic fungi, and additions are constantly being made, since it is only by this means that the true nature of the disease-causing organisms can be discovered and appropriate measures suggested for dealing with them.

III.—PUBLICATIONS.

In January, 1901, an illustrated work on *The Fungus Diseases of Cabbage and Cauliflower* was published, followed by several other works during the year. *The Fungus Diseases of Stone-fruit Trees* will be issued very shortly, and the various rusts which affect our native and cultivated plants are at present being dealt with.

A continuation of the works recorded in the previous Report are here given, consecutively numbered for convenience, but no mention is made of the various articles which have appeared in the Departmental Journal :—

73. Fungus Diseases of Cabbage and Cauliflower in Victoria and their Treatment. With six coloured plates and figures. Department of Agriculture, Victoria (1901).

74. The first recorded Fungus parasite on *Epacris*. Vict. Nat., Vol. xvii., No. 10, February (1901).

75. Report on Diseased Apples. Guides to Growers, No. 48. Department of Agriculture, Victoria, April (1901).

76. The Shot-hole Fungi of Stone-fruit Trees in Australia. Proc. Linn. Soc., N.S.W., November (1901).

Papers have also been contributed on various fungus diseases to the Australian Association for the Advancement of Science and the Royal Societies of South Australia and Tasmania.

IV.—MISCELLANEOUS.

Although the principal diseases which have been made the subject of experiment have been already referred to, there are quite a number of others which have received attention. The Rusts are greatly in evidence when the conditions are favorable, and severe cases of Carnation Rust, Flax Rust, and Rose Rust came under my notice. Now that flax may be more extensively cultivated than hitherto, this disease will require to be watched, especially since the native flax (*Linum marginale*) is likewise very subject to it. In some cases, the black stage of this rust was very plentiful, and growers should at least burn such diseased portions in order to prevent the perpetuation of the fungus. The Rose Rust caused extensive losses of young stocks in some nurseries, and the treatment recommended in the January *Journal* has been tried, but it is too soon yet to give the full results.

Dodder in lucerne and ergot in rye-grass were also rather plentiful and information was given as to their nature and treatment. The ergot occurring in rye-grass seed was evidently not known to the innocent purchasers, for they were very much surprised to learn that it was dangerous to animal life, and that a serious epidemic of cattle in the United States, at first supposed to be the dreaded "foot and mouth" disease, was proved to be caused by ergotized food.

Experiments in the destruction of lucerne dodder, the nature of which was explained in the March *Journal*, were carried out at Bacchus Marsh, and the arsenite of soda was very effectual. All the patches treated with it died away, and it remains to be seen what effect it will have on the succeeding growth.

My assistant, Mr. G. H. Robinson, has proved himself an efficient worker, and his services have been invaluable both in the experimental field work and in the investigation of the numerous diseases affecting cultivated plants. He has also arranged the specimens in the herbarium so that they can be readily consulted by any one wishing to know the general appearance presented by any particular disease. In photographing specimens incidental to my work, and preparing lantern slides for lecturing purposes, he has further increased his usefulness, most of this being done in his own time, outside the ordinary office hours.

It is encouraging to find that there is a growing demand for the establishment of experimental plots, to practically demonstrate the treatment of a number of plant diseases, and though only a proportion of these requests can be complied with, those which are undertaken will doubtless result in showing how to increase profits through the avoidance of losses.

REPORT OF THE PRINCIPAL OF THE SCHOOL OF HORTICULTURE.

C. Bogue Luffmann.

I have the honour to submit a Report of the School, Field, and general work carried out under my direction during the past year, and also to make some recommendations regarding the future of the Estate and the Institution.

Number and Class of Students Attending.

The School Year commenced with about 50 students the majority of whom were women. Several of these have during the year completed a two years course, and left the Institution. The maximum number of male students attending was sixteen, but some of these were probationers and could not be enrolled for a full course of study and field work. The year closed with upwards of 40 enrolled students, 29 of whom submitted themselves for examination.

Students' Field Work from Month to Month.

The present incomplete and irregular form of the estate does not admit of direct and complete instruction of the student; but by means of constant reforms, new work, and the general routine, enough useful employment has been provided to enable students to support their school studies under the headings of:—

I. General Horticulture. III. Vegetable Growing.
II. Orcharding. IV. Villa Gardening.

A great variety of practical work has been carried out in each section, and with very satisfactory results.

In such practical work as land draining, land preparation, orchard planning, tree planting, pruning, stock raising, vegetable culture, and general gardening, some excellent work has been done by the senior students.

Class-room Studies.

The results of class-room studies are here appended, and show that a high average number of marks has been secured. Lectures have been given daily throughout the school year: and all class-room instruction well supported by field demonstrations and practice.

Scarcity of Trained Orchardists and Demand for Students.

At present the demand for locally trained students is far greater than the supply. Students showing capacity for the work are booked for positions long before completing their term here. During the past year upwards of 100 applications were received from orchardists and others desirous of starting as such, for students to manage or assist their enterprise. The conditions under which students are at present accepted and enrolled makes it difficult to thoroughly equip and

recommend them for positions in which they may with confidence be left to manage a branch, or the entire work of an agricultural estate. I therefore beg leave to recommend:—

Recommendations Regarding Enrolment of Students.

All students should be accepted as probationers for three months, and, on their giving satisfaction, be legally indentured for not less than two nor more than four years.

The physically and mentally unfit should not be admitted under any circumstances whatever. It is also necessary to fairly set out in the prospectus and terms of agreement that persistent field work is absolutely necessary. The "stop gap" student helps neither himself nor the work we are engaged in, hence it will prove more remunerative if but a very few capable students attend, as the surplus energy of the teaching and working staff, can for long be well spent in giving instruction and effecting improvements on this estate.

New and Reform Work.

As much time and labour as could be spared from ordinary routine of the planted portion of the estate has been devoted to effecting heavy reforms and improvements on formerly waste areas.

At the close of the year 1900, arrangements were made with the Richmond City Council for the depositing of street refuse on this estate. The material has been received throughout the year, and though its reception has imposed a very heavy strain on the working strength of all engaged here, several acres of once rocky and useless land has been reclaimed and supplied with such a surface-dressing and form as will make it extremely attractive and valuable for all future time. The refuse is still being received, and, according to the terms of agreement, enough material will be deposited here to turn what was a poor and unsightly place into a rich, well-ordered, picturesque, and extremely valuable property at little or no cost.

By the aid of this refuse, entire reforms are made possible.

A new main entrance, 15 chains in length, has been cut through a formerly waste area. This work imposed the quarrying of rock to the depth of several feet, the filling up of deep hollows, and the laying of heavy stone culverts and drains to secure efficient drainage to a large portion of the estate.

As the levels of more than half of the estate—about 20 acres—have been materially affected, new fencing has been run on new lines, and a great quantity of material in the form of clay and rocks has been removed to secure form and value to the areas newly fenced.

A section of open land has been trenched and prepared for planting.

Some of the more needy portions of the old garden and orchard have been re-drained.

The erection of a new stable called for a line of approach, and this has been provided.

Several pieces of land have been grubbed, graded, trenched, dressed, and formed, to serve for orchard and ornamental trees.

Plotting and planting has been carried out on all prepared areas.

The routine work of the estate has been extremely varied, as great a variety of orchard, vegetable, and flower garden work being kept constantly in hand as would admit of the student and interested visitor acquiring definite instruction from each operation.

Ruinous Hailstorm.

No disasters or set back of any kind occurred as the result of climatic change until 14th November. The fruit trees were then well furnished with fruit, and the wood growth extremely healthy and clean, considering the age and shape of the trees and the poverty of the soil in which most were growing. On the above date, the great hailstorm broke here, and played terrible havoc with all vegetation. Not only was the crop and foliage destroyed, but scores of trees and plants were beaten out of existence, or deprived of their bark to such an extent as to render them useless. A particularly strong young orchard, which was furnishing decidedly necessary and helpful instruction, was all but destroyed, half the trees calling for removal, and the others serving only as "stocks" on which to start new heads by grafting.

Lectures and Field Work in Country Districts.

During the year several lectures and field lessons were given in country districts. These at the week end, as the only time possible.

Lectures in Melbourne and Suburbs.

About 30 lectures and ten field lessons were given during the year in Melbourne and its outlying suburbs.

Correspondence.

This has been very heavy. The number of inquiries from fruit-growers and others engaged on the land, calling for detailed information on such a variety of subjects as to entail an immense amount of heavy and careful writing.

Visitors.

These have attended at the rate of about two per day (that is, *bonâ fide* fruit-growers), but whilst it is, of course, necessary to afford every assistance to these, a great deal of the estate is so irregularly contrived that straightforward instruction is not forthcoming. This defect may shortly disappear in face of the reclamation and planning of the entire property.

Recommendations.

In order that the institution may be enabled to perform its true functions at the earliest possible date, it is distinctly necessary that—

(i) Extra labour be provided to grub and clean the irregular areas: £250.

(ii) Two workmen's cottages, in order to provide the necessary protection and management at all seasons: £500.

(iii) Several gates, a few chains of fencing, repairs to existing fencing, and one or two good implements: £200.

With the above materials and money provided an estate would exist wherein a great variety of distinctly profitable work could be carried

on through all the future. The situation, the volume of local population, the demands of the country and the visiting public all combine to make such an institution distinctly valuable, and it is false economy to spoil what may prove a very good ship for the ha'porth of tar.

Herewith is a list of the principal new and reform work submitted to students, also the rules, subjects for, and results of the year's work and examinations.

APPENDIX.

School Course 1901.

I. Principal New and Reform Work.
II. Rules for Examination.
III. Subjects for Competition and Examination.
IV. *Results of Examinations.*

Principal New and Reform Work.

For Students' Instruction, Winter 1901.

1. Make flower garden extensions on south side of estate to above line of pavilion.
2. Grub, clean, make up, and plot angle piece of top orchard.
3. Make main approach from bridge gate to pavilion gate.
4. Grading out for fencing lines, erection of fences, making culverts, main drains, and ditches.
5. Planning and forming the Park lands.
6. Altering levels in front garden borders, paths, and turf.
7. Draining the most needy areas.
8. Planting out of fruit trees and plants of all kinds.
9. Completion of plan for stable yard, styes, fowl yard, manure and rubbish pits, sewerage, &c.
10. Dressing as much land as possible with suitable manures.
11. Preparation and planting plots with permanent vegetables.

Rules for Examinations, 1901.

1. All Essays must be original. The substance of Lectures and General Discussions will be admitted, but copying from Text-books, Standard Works, Journals, or the inclusion of matter foreign to the subject of any Essay will disqualify.
2. Three or more students must compete in each subject or no prize will be given.
3. The value of any prize will correspond with the value of the Essay or work done.
4. Essays must be handed to the Principal not later than 6th November, 1901.

Subjects for Competition, 1901.

Seniors.

1. *Essay.*—Harvesting, storing, packing, and marketing twelve leading fruits at home and abroad; degrees of ripeness, fruit rooms, packing material, packages, consigning, &c., to be clearly stated. Four to six pages foolscap.

2. *Essay.*—Promoting, forming, arrangement, and management of the spur or fruiting shoot in deciduous fruit trees.
   Clear drawings or verbal descriptions of the plan adopted to be given. Four to six pages foolscap.
3. *Essay.*—Objects sought and general methods of pruning, disbudding, and thinning during the vegetative period in deciduous fruit trees. Three to five pages foolscap.
4. *Botany.*—Essay on the Vegetable Kingdom ; its divisions, subdivisions, and the general character of each. Four to eight pages foolscap.
5. *Orchard Pests.*—Essay.
   Part 1—
   On the Natural Orders of Insects to which our fruit-tree pests belong, and means for the suppression of aphides, scales, moths, beetles and flies.
   Part 2—
   Fungoid diseases of fruit trees and their remedies. Four to eight pages foolscap.
6. *Field Demonstration.*—General management of citrus and table grapes.
7. *Field Demonstration.*—Pruning and general management of row of mixed stone fruits.
8. *Field Demonstration.*—Vegetable and salad culture ; Spring and early Summer crops, one full sized bed for each.
9. *Field Demonstration.*—Soil preparation and management with hand and horse implements.
10. *Flower Garden Practice.*—Pruning, bedding out, and detailed work from August to December.
11. *Principal's Prize* for general excellence in class and field work.
12. *General Examination.*

2nd Year Students.

1. *Essay.*—The Principles of Pruning Deciduous Fruit Trees ; from planting to nearing maturity ; to induce fruitfulness ; when in full bearing ; when on the decline ; renovating old trees. Four to six pages foolscap.
2. *Essay.*—Bush Fruit Culture.—Gooseberry, currants, raspberry, strawberry, cape gooseberry, passion fruit ; localities, soils, manures, cost per acre till returns come in, normal returns in weight and value, markets, cultural methods, diseases and remedies. Four to six pages foolscap.
3. *Essay.*—Fruit Tree Stocks : when employed, kinds for Victoria, how propagated, method and season of working, &c. Three to five pages foolscap.
4. *Botany.*—Essay on the Life History of a Flowering Plant : the structure growth, and functions of its parts. Three to six pages foolscap.
5. *Orchard Pests.*—Essay on four insects and four fungi most destructive to Fruit Trees in Victoria, and remedies. To be accompanied by specimens of the pests dealt with. Three to six pages foolscap.
6. *Field Demonstration.*—Preparation and management of soil and plants in vegetable or flower garden, August to December.
7. *Field Demonstration.* — Pruning for wood and fruit : apples, pears, apricots, vines, peaches, plums.
8. *Field Demonstration.*—(Groups of three or more students.) Laying out an acre for orchard trees.
9. *Best Diary or Book of Notes* on class and field work of the year.

10. *General Examination.*
11. *Principal's Prize* for general excellence in class and field work.

1st Year Students.

1. *Essay.*—The soil and the influences which affect it in favouring plant growth. Three to five pages foolscap.
2. *Essay.*—Advantages of, and methods of draining, grading, and deep working of orchard and garden land. Three to five pages foolscap.
3. *Essay.*—The functions of different parts of trees : roots, leaves, sap, bark, buds, and the influences which go to affect changes in each. Four to six pages foolscap.
4. *Botany.*—Essay on the growth of a bean plant and of a wheat plant : the structure and functions of the different parts. Three to five pages foolscap.
5. *Orchard Pests.*—Essay on the life history of a moth, a beetle, a scale, and an aphis. Three to five pages foolscap.
6. *Field Demonstration* of digging and general treatment of soil, August to December.
7. *Field Demonstration* of pruning fruit trees or garden plants.
8. *Field Demonstration* of root, stem, and branch grafting and budding.
9. *Stable Work.*
10. *General Examination.*
11. *Principal's Prize* for general excellence in class and field work.

Senior Examination, 1901.

I. What species of fruit are wanted for export, and which varieties of each keep and carry well ?

II. Name sites favorable around Melbourne with aspect, nature and depth of soil, to table grape, pear, lemon, and apple.

III. What are the most important ingredients of soil, and through what manures and other agencies are they supplied ?

IV. What are the advantages of cincturing, lancing, bandaging, and hardening of bark, and what trees stand to benefit ?

V. Should the sap move quickly or slowly in—*a.* young, and *b.* strong trees, and why ?

VI. State as fully as you can the favorable condition of soil in Spring, Summer, Autumn, and Winter, in order to prove wholesome and acceptable to the roots of plants.

VII. Give a forecast of the work we should do in—1st. Old pears ; 2nd. Dwarf apples ; 3rd. Young plums during the remainder of this Summer, making allowance for what the storm has done.

VIII. Detail the most common and profitable means of disposing of orchard and garden produce in the local and other markets.

IX. Give as full a list as you can of all the defects in soil, climate, management, and condition of trees, as they tend to favour the development of animal and vegetable parasites.

X. What price could you afford to give for distinctly favorable apple, peach, lemon, and vine land, having regard to the comparative returns and duration of profitable life of each ?

XI. Explain the effects of—*a.* a long, dry summer ; and, *b.* a short, wet summer, on the wood and fruit forming powers of a deciduous fruit tree.

XII. What kinds of rock "break down" under the influence of the weather, facilitate drainage, and become useful for dressing and improving soil ?

XIII. Explain as fully as you can the good and bad effects of heat, air, light, and cold on the development of bark, and conduct of sap in trees growing under local conditions.

XIV. What fruits can Victoria dry at a profit, and where?

XV. What kinds of fruit trees must be irrigated in order to make them distinctly profitable over a long period?

XVI. What guides you in respect to the depth, season, and manner of sowing seeds?

Examination, 1901.

2nd Year Students.

I. Between what points of temperature do our leading fruit trees thrive? Which are able to stand greatest extremes of moisture and drought?

II. Name the seasons and conditions favorable for planting out cabbages, potatoes, strawberries, lemons, and deciduous fruit trees.

III. List a group of at least four fruits of high value suited to a particular district in Victoria, the order in which they would come in, and the markets they would serve.

IV. Set out in regular order and give approximate cost per acre of the various work and preparation for a peach, pear, lemon, or table grape area.

V. Give the seasons for manuring—

a. Wet and cold,
b. Heavy and dry,
c. Poor and hot

soil, and the class of manure each stands most in need of, irrespective of the crops to be grown.

VI. Give appropriate length of trunk, size, and structure of a fruit tree in—

a. Hot, dry, and exposed position,
b. Wet, cool, and airless position.

VII. In selecting a site for a commercial orchard, what are the natural conditions and advantages to be sought?

VIII. Under what circumstances and conditions is soil of value to the roots of plants?

IX. State briefly the nature of Summer work on soil where—

a. Young trees are planted.
b. Trees are overbearing and weakly.
c. Trees are overstrong and unfruitful.

X. What are the objects of "green or summer pruning" apples and pears, and how does age and condition of tree affect treatment between Spring and Autumn?

XI. What are the objects sought and results of hoeing, digging, trenching, subsoiling, ploughing, harrowing, and rolling?

XII. How are roses, vines, passion fruit, lemons, herbaceous plants, and apples propagated, and at what seasons?

XIII. What fruits and vegetables are best adapted to small areas and small means, and how long would you have to wait for returns from those you select?

XIV. What surrounding features and general conditions would govern your design for an ornamental garden?

XV. How would you produce and lay the foundation for a *strong* single rod, a *weak* single rod, and a T shaped espalier vine?

XVI. Under what conditions of growth, harvesting, and storing does fruit stand to keep well?

Junior Examination, 1901.

I. What are the ordinary influences of heat and cold, crops, water, manure lime, and cultivation on soil?

II. *List the twelve most profitable fruits for Victoria, and class of country in which each will thrive.*

III. What are the ordinary objects of Winter and Summer pruning of—
- *a.* Young, and
- *b.* Mature fruit trees?

IV. What number of acres of any individual or group of fruits could be managed entirely by one man?

V. Why is depth more important than quality of soil in a hot, dry climate?

VI. *Why are shady and airless and also very much exposed sites bad for fruit trees?*

VII. Give some ideas of the seasons for planting main crop onions, potatoes, *cauliflowers, tomatoes, and lemon trees.*

VIII. What kinds of fruits can be successfully grown in the irrigation areas of the north of Victoria?

Results of Examinations, 1901.

FIRST YEAR.

MAXIMUM, 80.

—	Question								Total.
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	
W. Rickard	10	9	9	0	10	10	8	8	64
A. E Anderson	10	10	8	0	8	10	7	8	61
H. Brown	6	6	8	8	8	8	8	8	60
T. Kempster	8	3	6	...	5	8	8	8	46
R. Austin	10	...	7	0	6	8	8	0	39

SECOND YEAR.

MAXIMUM, 160.

—	Question																Total.
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	XV.	XVI.	
H. R. Ward ...	8	8	8	9	10	10	10	10	9	10	10	10	10	10	8	8	148
M. Thatcher ...	8	9	7	7	9	10	8	9	9	8	10	10	9	10	10	10	143
L. Lothian ...	8	7	10	8	8	10	10	0	8	9	8	8	5	9	8	9	125
F. Godfrey ...	7	10	9	7	9	10	8	9	6	6	8	10	7	10	...	8	124
C. Jenkins ...	9	9	4	3	7	7	8	4	6	9	8	9	8	8	7	8	114
H. E. Bosse ...	9	9	7	7	8	7	7	6	7	5	9	6	5	4	0	9	105
S. Jerrems ...	6	8	9	5	5	7	6	6	7	5	5	6	5	8	6	8	102
A. Campbell ...	5	6	5	6	8	3	6	8	9	6	6	5	8	6	6	7	100
A. E. Johnston ...	7	7	8	5	9	4	7	4	2	8	8	5	6	7	3	8	98
J. Scott	4	6	2	3	8	5	8	0	3	8	8	4	6	3	7	8	83

THIRD YEAR.

MAXIMUM, 160.

—	Question.																Total.
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	XV.	XVI.	
I. Higgins ...	8	10	10	10	10	8	9	8	9	8	10	10	10	9	7	10	146
A. T. Murray ...	8	9	9	6	10	10	10	8	10	8	10	10	9	8	9	7	141
I. McWilliam ...	8	9	9	8	10	10	10	8	10	10	10	6	8	9	9	7	141
M. W. Thompson ...	9	6	6	7	9	8	8	8	9	7	10	10	9	10	8	8	132
C. Allan ...	3	9	9	6	5	8	7	8	10	5	10	6	10	8	7	10	121
C. Purton ...	7	10	8	10	0	8	5	5	10	9	10	9	8	9	10	8	126
A. Wollen ...	7	7	8	6	9	6	6	6	10	5	6	8	10	...	8	7	109
A. Gruber ...	3	0	3	8	10	7	7	2	8	2	10	9	5	9	5	6	94
M. Watson ...	2	5	0	6	9	8	9	...	10	...	9	4	8	6	5	10	91
E. Officer ...	3	7	...	9	6	6	4	...	10	...	8	8	...	8	8	6	83
D. Carter ...	0	0	0	0	8	5	7	3	4	3	7	2	5	6	8	4	62

Economic Entomology, 1901.

—	Question										Maximum 100.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	
H. R. Ward	8	10	10	7	8	10	10	8	6	10	87
M. Thatcher	6	10	10	10	6	7	9	8	8	10	84
C. Allan	8	10	8	9	8	10	10	6	10	5	82
A. Wollen	5	8	10	6	5	8	9	6	5	6	68
J. Scott	0	8	0	5	0	4	10	5	...	10	42
JUNIORS. MAXIMUM 80.											
W. Rickard	2	10	0	6	8	5	10	4	...	...	45
H. Brown	8	5	5	...	...	2	...	2	...	...	22
R. Austin	2	6	0	4	0	0	3	5	...	...	20
T. Kempster	4	0	5	1	...	2	3	2	...	...	17

Structural Botany, 1901.

MAXIMUM 100.

—	Question										Total.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	
H. R. Ward	10	10	7	10	10	9	9	10	8	8	91
M. Thatcher	10	8	0	10	10	7	10	10	8	8	81
C. Allan... ...	10	8	0	9	8	6	8	8	8	5	70
A. Wollen	8	8	0	6	4	8	9	8	5	6	62
J. Scott	5	6	0	5	8	8	5	6	4	2	49
JUNIORS. MAXIMUM 80.											
W. Rickard	9	8	0	9	5	4	4	8	...	...	47
R. Austin	8	4	0	3	2	5	4	6	...	...	32

Results of Essays, 1901.

First year.			
The soil and influences affecting it favorably	2nd	A. E. Anderson	... 75 per cent.
Second year.			
Principles of Pruning	1st	F. R. Godfrey ...	... 85 "
		M. Thatcher ...	... 85 "
	2nd	H. R. Ward ...	... 80 "
Fruit-tree Stocks	1st	F. R. Godfrey	... 80 "
	2nd	H. R. Ward ...	... 75 "
		M. Thatcher ...	... 75 "
Third year.			
Harvesting and Marketing	1st	I. Higgins.	
		M. W. Thompson.	
	2nd	A. T. Murray.	
		C. Purton.	
Management of the Spur	1st	A. M. Wollen	... 90 per cent.
	2nd	A. T. Murray ...	... 85 "
Disbudding and Thinning	1st	I. Higgins ...	... 95 "
	2nd	C. Purton ...	... 90 "
		A. M. Wollen	... 85 "
	3rd	A. Gruber ...	... 85 "
Four Insect Pests and Remedies ...		M. Thatcher ...	... 85 "
		H. R. Ward ...	... 85 "
Natural Orders to which five Insect Pests belong		A. Wollen ...	... 50 "
The Life-history of a Flowering Plant		H. R. Ward ...	... 85 "
		M. Thatcher ...	... 80 "
General characters of Divisions of Vegetable Kingdom		A. Wollen ...	... 60 "

REPORT OF THE SPAYING EXPERT.

David Wilson.

The Value of Spaying.

Commencing from the date of my engagement, 20th October, 1900, up to 12th June, 1902, I have pleasure in reporting that the dairymen in those districts where practical work has been done are fast realizing the benefits of spaying their cull cattle, and also the advantage of using pure sires on their good cows, in order to raise the standard of their herds. Every cattle-man that has given thought to the subject is convinced that the spaying of culls and aged cattle is the right thing to do, and it is only the fear of serious loss through operating that has kept them from putting their convictions into practical effect. I have to thank those progressive cattle-owners, who, on my first visits to the various districts when the operation of spaying was looked upon with suspicion, gave numbers of their cattle as subjects to be operated on, providing for the dairymen around them an object lesson where actual results could be seen, thus helping me, on behalf of the Department of Agriculture, to prove by demonstration that spaying could be carried on practically without loss, and with considerable profit.

The loss by death in 4,866 cattle which I have operated on has come out under 1 per cent., or about one beast in 200.

It is of very great importance to the welfare of the dairying industry that the spaying of cull or unprofitable butter-producers should become general. It is difficult to arrive at the true percentage of culls in the herds, and in my opinion this will only be known approximately until that most necessary and useful method, the individual testing of dairy cows by the aid of the Babcock test and milk scales, becomes general; but, by what I have seen myself, and by the opinions of many shrewd and practical dairymen, I think I will be well within the facts by saying that from 15 to 20 per cent. of dairy cows are cast out of the herds annually, because they are unprofitable to the owners from various causes, such as a low percentage of butter fat, wrong in the udders, aged cattle, and cows that have aborted. When we consider that in round numbers we have nearly 500,000 dairy cattle in the State, and that from 15 to 20 per cent. of these are unprofitable butter-producers, it can be seen at a glance what a danger these culls are when traded on the markets and sold as either milkers or springers; and how important it is that they should be cut off from the breeding herds and sent to their proper destination—the meat market.

Spaying for Milking.—I only advocate operating on good milkers when they reach the age of nine or ten years, or when the owners think if they can get another year or eighteen months' milk from the cow, that it will be time to fatten her for the butcher, and fill her place in the dairy with a young and fresh animal. By treating cows in this way, before they get too old, I am certain that it would be a direct

saving to the country, for it is a well-known fact that in every recurrence of a bad season, or severe winter, numbers of old cows die off and are only worth the price of their hides. This is because they get in calf year after year, and are kept milking till they are worn out, lose their teeth, and must be absolutely unprofitable in any dairy.

Extent of the Work Done.

Since my engagement on 20th October, 1900, up to 12th June, 1902, I have done the following work in connexion with cattle :—

362 exhibitions of spaying.
4,866 cattle spayed, belonging to 596 owners.
315 pupils took lessons in operating.
7,508 stock-owners and others interested attended the various exhibitions.

The cattle operated on were all ages and conditions, and as the risk includes the operations of pupils and unsound cattle, the fact that loss by death after operating has come out under 1 per cent., must be regarded as very satisfactory. To show the increase in the work : from 20th October, 1900, to the end of June, 1901, 1,150 cattle were operated on, and 68 young men took lessons ; from August, 1901, up to June, 1902, 3,716 cattle were spayed, and 247 pupils took lessons. Some of the pupils have shown marked ability in operating, and should with practice be able to spay cattle successfully ; others who have shown promise of being successful will require several lessons before they get confidence in themselves.

The Gelding of Colts and Stallions.

By special request of the various agricultural societies under whose direction I have been working I have given during the last six months a number of practical demonstrations in the castrating of colts and stallions by the most modern method without searing, the instruments used being Kendall's Emasculator and the American Emasculator. Great interest has been taken in this work, and operating without searing is recognised by those that have seen results to be of undoubted value to horse-owners. No bleeding takes place, the operation being much easier, and causes the animal comparatively little distress.

I have given a total of 60 exhibitions of gelding; 134 colts and stallions have been gelded, belonging to 70 owners. All the operations were successful, and the horses well done. These exhibitions were in nearly every case given in combination with the spaying demonstrations, so that the people present could see both operations.

Caponizing Poultry.

In combination with spaying cattle and gelding colts and stallions, I have given by request a number of practical exhibitions of caponizing poultry, the subjects being roosters about four months old, and turkey gobblers about six months old. Much interest has been taken in

caponizing, and it is of value to the country people as an aid to keep up the standard of their poultry and in having better quality birds for export and table purposes. Mr. R. V. Dennis, of Warncoort, Mr. Charles Forrest, M.L.A., and Mr. John James, of Reccarton, three well-known poultry fanciers, were the first to have turkeys caponized successfully about three years ago, and they were so pleased with results that they are continuing the practice, and having their surplus male birds, both turkeys and roosters, operated on yearly.

I have already given 56 exhibitions of caponizing, 188 roosters and turkeys having been operated on. A few of the leading advocates of the system are:—Mr. W. Goldie of Port Fairy; Doctor White of Kyabram; the Yarrawonga Poultry Society; Mr. Bankin of Bairnsdale, Mr. Wellwood of Drouin; Mr. R. V. Dennis of Warncoort, and Mr. Charles Forrest, member for Colac. If the birds are properly prepared for the operation the loss is about 1 per cent. by accident.

SYNOPSIS OF PRACTICAL DEMONSTRATIONS FROM 20TH OCTOBER, 1900, TO 12TH JUNE, 1902.

Spaying Demonstrations.

362 exhibitions.
4,866 cattle spayed.
Belonging to 596 owners.
315 pupils took lessons.
7,508 stock-owners and others were present at the exhibitions.

Gelding of Colts and Stallions.

60 exhibitions during last six months.
134 colts and stallions gelded.
Belonging to 70 owners.

Caponizing of Poultry.

56 exhibitions of caponizing.
188 roosters and turkeys operated on.
Belonging to 56 owners.
Miles travelled by railway, 10,851½.
Taken with societies by road, 3,447½.

REPORT OF THE POULTRY EXPERT.

A. Hart.

Condition and Prospects of the Poultry Industry.

In presenting my Report for the past twelve months, I have much pleasure in stating that there has been a wonderful advance in all matters pertaining to the poultry industry, and prospects of a further improvement are distinctly noticeable. The large outlet for poultry and eggs provided by the demand in Great Britain, South Africa, West Australia, &c., has resulted in considerable competition between the different States, and the products of Victoria have not only reached a very large total, but their quality has resulted in top prices being realized. I feel quite certain that this industry is yet in its infancy, and there is certainly every encouragement for the Government to offer inducements for the extension and improvement of this important branch of our State exports. There is no reason why Victoria should not be able to place table poultry and eggs on the British market, holding their own with either American or Continental competition, and it should be quite possible for our State to derive a very large revenue from this source in the near future. There has been already a large increase among the population who take a great interest in poultry breeding, and there can be no doubt as to the result, providing that suitable breeds are selected.

During last year the number of poultry which passed through the Government Cool Stores for export was 200,000 head, comprising fowls, ducks, turkeys, and geese. The export of these birds was of considerable benefit to the farmer. There was an extra demand, and keen competition produced for birds suitable for the export trade, and the full value was realized for all varieties of poultry. An increased return of not less than £10,000, over and above ordinary market prices, was gained by the farmers through this means. The export trade of poultry for the past season will show a return of not less than £30,000. These figures are a large increase over the amount derived from this source during the previous year, supplying evidence that this industry is advancing with rapid strides and is proving of great benefit to the farmer and producer. Most of this poultry was consigned to the South African market, the large requirements of the United Kingdom being only credited with a few small shipments. Nothing but birds of the highest quality were shipped, and in the selection of this total 40,000 birds were rejected on account of poor condition and want of size. A large number were also condemned for various diseases, a strict supervision being maintained to insure the shipping of only perfectly healthy birds.

England last year paid £6,000,000 sterling for poultry and eggs from other nations. The market is increasing, and there is no doubt that Victoria has special advantages in competing for a large share of this extensive demand. Our State can supply large quantities of poultry to the British market when they are right out of season in the

United Kingdom. When poultry and eggs are scarcest in England we have the opportunity of shipping our products to meet the demand, and as our supply of both articles is plentiful at that time, we have a decided advantage over those countries contributing to the British market, which are situated north of the equator. This Department has proved by past shipments that there is practically an unlimited demand for poultry and eggs in Great Britain, providing that the quality is suitable to the requirements of the British trade.

The very large increase in the export of poultry caused a great amount of extra labour in killing, dressing, &c. This difficulty was surmounted by engaging a large staff of pupils, who were instructed by the Department's expert. They soon became proficient, and this enabled the work to be performed quickly and well. Besides providing hands for our own requirements, there were also a good number of expert poultry men sent through the Department to the neighbouring States, with satisfaction to all concerned.

Country Demonstrations.

During the year a large number of exhibitions and demonstrations were given at various places, including all the leading shows in Victoria. They embraced frozen exhibits of the various products most suitable for export trade, including chickens, turkeys, geese, ducklings, and game of all descriptions. These exhibits were shown in first-class condition, providing a valuable object lesson to farmers and others as to the correct method of preparing and packing. These exhibitions proved of much benefit to the farmer, and resulted in the general improvement of his stock, and are also responsible for a considerable portion of the increased return from poultry during the past year. One of the object lessons brought under the notice of the visitors was a comparison of the different qualities of poultry. A fair sample of the everyday supply to our local auctions was on view. They were in poor condition and of inferior quality, and their market value would be from 2s. 6d. to 3s. per pair. In comparison with these, a sample was shown which was of the quality and condition required for our export trade. These birds were large, and of good shape and condition, exhibiting a very wide margin, and carrying a local value of 4s. 6d. to 5s. per pair, being an increase of 2s. on each bird. A sample of ducklings nine to ten weeks old was also on view, these being of the Aylesbury and Pekin cross, and weighing 4½ lbs. to 5 lbs. each. Against this, another box was shown containing ordinary cross-bred ducks as usually sent to market. They were sixteen weeks old, weighing 4 lbs. each. Both samples had been fed under exactly the same condititions, showing a loss of six weeks in time and food on the latter birds, this representing at least 1s. 6d. per pair. The market value was also 1s. per pair less than the first-named birds, showing an all-round profit of 2s. 6d. per pair in favour of the Pekin and Aylesbury cross. Two consignments of turkeys were also exhibited. One of them had been sent to market in the ordinary crate generally used by the farmer, being low and unsuitable for the purpose, and causing the turkeys to arrive in a damaged condition, all the breast being bruised,

spoiling them completely for export. The other consignment was sent to market in a crate specially prepared by the Department for the purpose. The birds in the latter were in first-class condition, and were in every way suitable for export. Since the first demonstration of this kind was given at the Royal Show in September last, the increased size of crate has come into general use by the whole of the merchants in the city, and it has resulted in a material benefit to both the breeder and exporter. Farmers should always state when ordering coops from the agent if they are required for turkeys, so that suitable crates may be sent. The benefit of these displays is plainly apparent, providing plain and practical education to the farmers and poultry keepers throughout the State, and tending to produce uniformity in size and quality of birds and eggs for the export trade.

Object lessons were given at the Cool Stores during the three winter months. They were instituted for the benefit of the housewife and domestic servants. These lessons embraced all branches of preparing poultry for table, including larding and boning, which are carried out to a large extent in Great Britain. This was the first demonstration of its kind in the States, and it was well supported by the public, proving a success from the start. Many of the pupils expressed themselves in terms of praise on the valuable information gained, which enabled them to dress and prepare poultry for table in first-class style, with advantage to the carver, and also saving a large amount of time in the preparation.

Grading and Packing Eggs.

The exhibits of eggs at the various shows were also educational and interesting. The proper method of grading and packing for local and export trade was shown. In the export trade, cardboard sections, lined with damp-proof paper, were provided for each egg. This prevented the eggs from contracting any taint whatever during their storage in cool chambers or in transit to the London market. The eggs intended for export should be graded to size and colour, each colour being packed separately. This will allow the purchaser to select the colour he prefers, and result in top prices being obtained. Another important matter is to see that all eggs sent in for export are perfectly fresh and clean.

During the past two years there has been a marked improvement in the uniformity and cleanliness of the eggs consigned for export, but there is still room for improvement in this direction. Strict attention must be paid to the conditions laid down to insure the success of the egg industry. This has been borne out by the results obtained from the various shipments sent to London from the Government Cool Stores during the past seasons. The consignments were selected and packed with great care, and arrived in excellent condition, being in every way suitable to the requirements of the trade. They were placed on the market in direct competition with fresh eggs, and realized from 1s. to 1s. 2d. per dozen. At the time these eggs were shipped the local market was glutted, and prices were low. The returns left a considerable margin of profit after all expenses were paid.

In conclusion, I would again bring under your notice the advisability of fostering and extending this national industry, so as to induce farmers and others to breed large stocks of suitable birds for the trade. The unlimited outlet in both poultry and eggs will effectually prevent anything like a glut in either products. The British market can absorb all that we can produce, and a very large revenue should be derived from this source by our State when the trade is thoroughly established and developed.

STATISTICS.

DAIRY PRODUCE, ETC.

Table showing Approximate Value of Produce exported through the Government Cool Stores for years ending 30th June, 1901 and 1902.

Produce.	1901.	1902.
	£	£
Dairy Produce	1,311,566	862,369
Poultry and Game	8,706	19,040
Rabbits and Hares	94,312	124,232
Meat and Sundries	65,288	95,246
Total	1,479,872	1,100,887

Total Exports of Produce through the Government Cool Stores, Flinders-street, from 1st July, 1900, to 30th June, 1901.

Grand Total.	Description of Produce.	Value, C.I.F.
		£
12,638½	Tons Butter...	1,301,765
432	Crates Cheese	1,080
6,570	Cases Condensed Milk and Cream	8,212
12,207	Dozen Eggs	509
1,508,648	Pairs Rabbits	94,290
112	" Hares	22
51,825	Heads Fowls and Chickens	6,478
8,856	" Ducks	1,328
3,303	" Turkeys and Geese	900
95,967	Carcasses Mutton	47,983
204	" Calves	408
772	" Pork	1,544
168	Sides Veal	168
312	Legs Mutton	47
5,175	Quarters Beef	12,938
905	Pieces Beef	905
21,370	Lbs. Sundries	445
1,701	Cases Fruit	850
		1,479,872

Total Exports of Produce treated at the Government Cool Stores for the period of twelve months from 1st July, 1901, to 30th June, 1902.

Great Britain.	South Africa.	Eastern, Intercolonial and other Ports, &c.	Total	Description of Produce.	Approximate Value, C.I.F.
					£
5,708	1,046	306	7,060	Tons Butter (Victorian) ...	762,480
155	418	246	819	" (Inter-State) ...	83,538
425	1,359	7,847	9,631	Crates Concentrated Milk and Cream	12,039
...	16,188	70,063	86,251	Dozen Eggs	4,312
60	124,321	1,670	126,051	Heads Fowls and Chickens...	15,769
...	9,304	855	10,159	" Ducks	1,693
...	3,641	957	4,598	" Turkeys and Geese ...	1,533
...	322	1,496	1,818	" Game	45
1,817,500	9,624	30,154	1,857,278	Pairs Rabbits	123,818
1,608	464	...	2,072	" Hares	414
134,524	12,037	3,307	149,868	Carcasses Mutton and Lamb	82,427
...	295	58	353	" Calves	706
854	294	120	1,268	" Pork	2,536
...	890	...	890	Sides Veal	890
...	691	252	943	Pieces Beef	1,179
250	...	...	250	" Mutton	25
10,731	300	125	11,156	Cases Fruit and Fruit Pulp...	6,972
...	10,043	20,663	30,706	Sundries	51
					1,100,887

TABLE SHOWING EXPORTS OF VICTORIAN PERISHABLE AND ALLIED PRODUCTS, AND PORTS OF DESTINATION, FOR THE YEAR 1901.

Countries to which Exported.	Butter.	Cheese.	Milk and Cream.	Milk, Concentrated.	Milk, Preserved.	Ham and Bacon.	Eggs.	Poultry.	Pork, Fresh.	Pork, Salt.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	dozen.	packages.	centals.	centals.
United Kingdom ...	17,180,468		...	22,530	...	...	...	9	...	...
New South Wales ...	159,109	77,089	352,690	3,512	3,865	207,155	8,640	11	11	6
New Zealand	200	...	...	...	...	...	...	4	...	...
Queensland	3,310	160	...	2,760	23,856	560	...	10	...	...
South Australia ...	681,165	17,748	314,470	8,246	53,088	9,773	768	...	...	1
Tasmania	200,739	21,853	2,590	65,629	5,448	30,401	3,228	...	...	2
West Australia ...	3,531,009	114,409	9,680	507,587	22,658	2,523,044	132	701	...	95
Fiji	17,996	...	...	...	...	...	...	...	...	...
Burmah	24,274	123	...	...	...	58	...	...	...	...
Cape Colony	2,448,050	2,878	...	3,136	480	12,011	13,306	1,737	...	1
Natal	3,980,634	6,278	...	126,901	11,050	9,896	11,832	3,715	...	...
China	30,994	1,297	...	120	...	131	...	...	...	...
Egypt	2,120	...	...	...	...	1,000	...	...	...	...
Guam	15,266	1,274	12,220	210,245	1,410	3,805	2,472	...	...	16
Hong Kong	104,296	121	...	...	...	...	...	...	...	...
India	24,353	6,791	...	...	...	854	...	...	...	1
Ceylon	128,149	19,201	...	2,944	480	376	...	...	...	3
Japan	8,910	...	...	80	...	601	...	...	...	...
Java	231,199	...	...	...	...	48	...	...	...	...
Malden Island	50	22	...	...	...	220	...	...	...	...
Mauritius	6,300	...	...	...	...	...	...	...	...	...
Philippine Islands ...	166,882	50,422	250	210,594	3,040	792	...	...	...	...
Siam	354	...	...	...	...	372	...	...	...	...
Straits Settlements ...	184,460	5,961	...	...	...	...	...	...	...	...
Corea	1,556	...	...	...	...	...	...	...	...	...
Celebes	1,450	...	...	...	...	...	...	...	...	...
France	400	...	...	...	...	...	...	...	...	...
Sumatra	2,880	...	...	...	...	...	...	...	...	...
Sandwich Islands ...	8,820	...	...	...	...	...	...	...	...	...
Aden	1,000	...	...	...	...	...	...	...	...	...
Beira	...	...	...	...	...	...	...	...	...	...
Thursday Island ...	...	...	...	...	...	...	...	...	...	...
Belgium	...	...	...	...	...	...	...	...	...	...
Totals	29,146,393	325,627	691,900	1,164,284	125,375	2,801,097	40,428	6,187	11	125

TABLE SHOWING EXPORTS OF VICTORIAN PERISHABLE AND ALLIED PRODUCTS, AND PORTS OF DESTINATION, FOR THE YEAR 1901—*continued.*

Countries to which Exported.	Mutton and Lamb.	Beef, Frozen.	Rabbits and Hares.	Preserved Rabbits.	Preserved Meats.	Fresh Fruit.	Dried Raisins.	Dried Fruit.	Bottled and Canned Fruits.
	carcases.	centals.	pairs.	lbs.	lbs.	bushels.	lbs.	lbs.	dozen pints.
United Kingdom ...	172,222	21	2,058,162	1,503,070	1,088,792	24,811	...	201	...
New South Wales ...	454	...	...	138,060	27,687	176,443	270,052	36,267	21,545
New Zealand ...	...	...	...	...	856	14,330	233,100	955	435
Queensland ...	...	...	248	5,472	29,388	24,376	229,815	132,763	9,417
South Australia ...	...	...	...	...	4,470	1,798	2,218	293	246
Tasmania ...	14	12	...	6,756	59,124	18,881	83,612	12,695	343
West Australia ...	3,490	794	23,564	8,608	251,027	6,657	3,698	8,189	98,643
Fiji ...	...	...	...	...	...	4	192	...	880
Burmah ...	...	...	...	...	168	...	...	30	774
Cape Colony ...	11,688	2,544	7,029	44,712	221,659	758	...	1,064	16,484
Natal ...	2,234	955	3,604	73,280	368,412	2,296	...	995	6,544
China ...	...	...	...	4,032	192	100	...	60	172
Egypt ...	416	77	...	...	...	...	...	...	...
Guam ...	...	...	...	768	1,860	1,207	636	959	446
Hong Kong ...	...	...	...	960	326	3	...	...	648
India ...	...	...	...	480	1,849	1,034	413	2,625	3,807
Ceylon ...	...	...	120	480	7,845	1,611	458	3,761	2,535
Japan ...	...	...	...	...	3,000	...	...	...	...
Java ...	...	...	...	...	384	2	104	...	4,974
Malden Island ...	...	...	...	...	...	...	...	20	105
Mauritius ...	...	...	...	...	...	...	...	...	...
Philippine Islands	...	...	...	...	...	...	...	732	84
Siam ...	...	...	...	...	...	...	...	...	4
Straits Settlements	...	...	...	480	672	20	58	...	204
Corea ...	...	...	...	...	...	...	...	...	...
Celebes ...	...	...	...	...	1,512	...	...	...	...
France ...	...	...	...	...	...	...	...	...	14
Sumatra ...	...	...	...	...	...	...	...	...	...
Sandwich Islands	...	...	...	...	...	...	...	...	266
Aden ...	...	...	...	...	...	...	...	...	...
Beira ...	...	...	...	...	...	...	...	...	...
Thursday Island	...	...	...	...	...	...	...	...	21
Belgium ...	...	...	...	...	...	...	...	...	...
Totals ...	190,518	4,403	2,092,727	1,787,158	2,069,223	275,379	824,806	201,609	168,591

EXPORTS of Perishable and Allied Produce from Victoria during the last three years.

—		1899.	1900.	1901.
Butter	lbs.	36,237,469	37,793,161	29,146,393
Cheese	"	671,639	827,025	325,627
Milk and Cream	"	*548,680*	*767,260*	*691,900*
Milk, Concentrated ...	"	424,580	808,606	1,164,284
Milk, Preserved	"	57,562	200,478	125,375
Ham and Bacon	"	1,251,834	2,205,474	2,801,097
Eggs	dozen	82,128	82,068	40,428
Poultry	packages	1,645	4,461	6,187
Pork, Fresh	centals	85	1,168	11
Pork, Salt	"	49	127	125
Mutton and Lamb ...	carcasses	167,910	178,094	190,518
Beef	*centals*	*1,633*	*3,152*	*4,403*
Rabbits and Hares ...	pairs	2,353,296	2,839,112	2,092,727
Rabbits, Preserved ...	*lbs.*	*3,964,471*	*3,266,127*	*1,787,158*
Meat, Preserved	"	795,576	1,786,917	2,069,223
Fruit, Fresh	bushels	140,840	172,199	275,379
Raisins	lbs.	525,235	663,177	824,806
Dried Fruits, Other ...	"	413,667	195,255	201,609
Canned and Bottled Fruits ...	*doz. pints*	*48,973*	*109,746*	*168,591*

LIVE STOCK.

RETURNS of Stock introduced into the State of Victoria, from 1st January, 1902, to 31st May, 1902.

OVERLAND.

Crossing Place.	Horses.	Cattle.	Sheep.	Calves.	Pigs.
Apsley	10	7	429	...	...
Buchan	311	127	...	...	...
Cobram	...	51	1,854	12	125
Dartmoor	90	1,080	...	29	...
Delegate	106	2,508	8,323	34	47
Echuca	95	2,161	39,878	63	56
Gooramadda	143	367	27,342	...	46
Jinjellic	83	2,236	32,995	...	...
Koondrook	70	575	31,139	9	25
Lockhart	589	81	1,735	1	...
Mildura	3	89	1,364	...	...
Narung	21	...	3,904	...	...
Nelson	...	32	...	...	...
Penola	53	...	1,938	...	...
Strathdownie	77	102	1,747	...	...
Swan Hill	117	1,750	52,678	...	25
Tintaldra	157	3,274	18,146	...	...
Tocumwal	15	1,311	23,712	...	130
Wahgunyah	24	560	20,453	...	157
Wodonga	2,508	9,916	120,409	...	...
Yarrawonga	121	759	9,906	...	459
	4,503	25,996	379,032	148	1,070
SEAWARDS.					
Melbourne	206	73	2,345	...	2
	4,709	26,069	381,377	148	1,072

SHEEP inspected by District Inspectors of Stock, from 1st January, 1902, to 31st May, 1902.

Month.	Number Inspected.
January	37,232
February	36,335
March	28,534
April	45,483
May	48,912
	196,496

RETURN of Sheep Exported Overland from the State of Victoria, from 1st January, 1902, to 31st May, 1902.

Month.	Number.
January	9,618
February	8,946
March	17,163
April	10,454
May	8,768
	54,949

EXPORTS of Live Stock during March, April, and May, 1902.

1902.	Horses.	Cattle.	Sheep.	Pigs.
March	175	452	10,646	136
April	268	101	7,194	95
May	148	118	9,460	88
Total	591	671	27,300	319

In addition, certificates have been granted for a large number of dogs, fowls, and hides exported to the various States.

DESTINATION of Live Stock Exported in March, April, and May, 1902.

	Horses.	Cattle.	Sheep.	Pigs.
Tasmania	106	9	6,812	145
West Australia	163	588	20,408	174
New South Wales	51	13	25	...
South Australia	18	...	10	...
Queensland	4	...	5	...
New Zealand	7	1	40	...
South Africa	76	6	...	...
Mauritius	125	...	...	...
Eastern Ports	40	54	...	...
England	1	...	...	...
Total	591	671	27,300	319

LIST of Foreign Stock Imported and Quarantined at the Port of Melbourne for the Five Months ending May, 1902.

Date.		Horses.	Cattle.	Sheep.	Pigs.	Dogs.	Owner.
1902.							
January	6	...	2	...	...	...	G. T. Chirnside
,,	13	...	...	...	...	2	John Carey
,,	28	...	...	...	...	2	W. Goddard Brown
February	10	...	...	...	...	1	Lee and Rial
,,	14	...	9	...	...	...	J. McLaughlan
,,	25	3	...	...	...	...	J. B. Derham
,,	28	8	...	...	...	...	Campbell and Sons
March	4	...	...	...	...	1	F. J. Olney
,,	7	2	...	...	...	...	S. W. Gibson
,,	25	...	...	...	...	1	B. W. Bagenal
April	29	2	...	...	...	...	Andrew O'Keefe
May	1	1	...	...	...	...	S. Margrett
,,	1	1	...	...	...	...	C. F. Glasscock
,,	30	...	...	...	...	2	H. S. Rudduck
,,	30	...	...	...	...	3	Bunth and Rudd
Total	...	17	11	...	...	12	

IMPORTS AND EXPORTS OF FRUIT.

IMPORTS OF FRUIT FROM AUSTRALIAN STATES DURING 1901.

—		Queensland.	New South Wales.	South Australia.	Tasmania.
Bananas	bunches	490,296	...	...	...
Pineapples	cases	30,415	...	..	24
Oranges	,,	14,470	238,195	31	...
Cucumbers	,,	2,659	275	...	...
Strawberries	,,	1,070	50	..	...
Mangoes	,,	202	...	1	...
Passion Fruit	,,	28	6,490	...	...
Bananas	,,	20	...	...	...
Granadillas	,,	13	...	...	...
Paw-paws	,,	3	...	...	...
Mixed Fruits	,,	3	1	6	...
Custard Apples	,,	2	...	...	...
Lemons	,,	...	21,166	8	...
Tomatoes	,,	...	3,016	...	...
Peaches	,,	..	1,655	13	...
Persimmons	,,	...	448	...	...
Apricots	,,	...	290	...	26
Loquats	,,	...	250	103	
Apples	,,	...	223	...	2,414
Nectarines	,,	...	100	...	...
Melons	,,	...	24	...	...
Plums	,,	...	18	1,328	435
Grapes	,,	...	1	6	...
Egg Fruit	,,	...	...	2	...
Black Currants	,,	...	...	...	3,661
,,	casks	...	...	...	316
Cherries	,,	...	...	...	312
Raspberries	cases	...	...	...	151
Pears	,,	...	...	...	11

IMPORTS OF FRUIT FROM BEYOND THE COMMONWEALTH DURING 1901.

—		Italy.	Palestine.	China.	United States.	Greece.	Japan.	Fiji	England.
Oranges ...	cases	4,800	36	92	...	...	11	...	...
Lemons ...	"	16,553	1,304	...	48	100	...	...	...
Apples ...	"	...	...	...	763	1	...	...	...
Shaddocks ...	"	...	...	15	...	...	...	...	...
Yams ...	"	...	...	...	...	...	...	1	...
Grapes ...	"	...	...	...	...	...	...	...	1

INSPECTION OF FRUIT IMPORTED DURING 1901.

Fruit.		Passed.	Condemned.	No. of Certificates.
Bananas	bunches	490,296	4,860 bunches 2,540 loads refuse	128
Oranges	cases	257,635	307	2,843
Pineapples	"	30,415	...	1,552
Lemons	"	39,179	184	1,472
Tomatoes	"	4,651	3	85
Apples	"	3,493	245	78
Peaches	"	1,669	...	81
Plums	"	1,172	...	400
Black Currants	"	2,718	...	...
"	casks	1,079	...	158
Apricots	cases	316	12	54
Strawberries	"	1,120	...	120
Loquats	"	417	...	41
Passion Fruit	"	6,887	...	421
Raspberries	"	151	...	38
Cherries	casks	171	...	95
Blackberries	"	312	...	142
"	cases	154	...	...
Granadillas	"	13	...	13
Shaddocks	"	14	...	4
Pears	"	11	...	1
Mangoes	"	193	20	101
Persimmons	"	448	...	53
Grapes	"	7	...	5
Nectarines	"	100	...	22
Mixed Fruits	"	5	...	3
Cucumbers	"	2,034	...	420
Melons	"	20	...	15
Yams	"	1	...	1
Paw-paws	"	3	...	3
Custard Apples	"	2	...	2
Egg Fruit	"	2	2	2
Total		844,698	8,173	8,453

PLANTS, ETC., IMPORTED FOR YEAR 1901.

Origin.	Plants.	Bulbs.
	packages.	packages.
New South Wales	327	2
South Australia ...	43	...
Tasmania	20	6
New Zealand	15	7
West Australia	*5*	..
Lord Howe Island	9	...
England	13	87
Ireland	..	1
France	8	...
Holland	1	24
Germany	.	4
Mauritius	..	1
China	3	12
Japan	23	12
Total	467	156

EXPORTS.

FRUIT INSPECTED FOR EXPORT TO AUSTRALIAN STATES AND NEW ZEALAND ONLY, DURING 1901.

Fruit.	No. of Cases Inspected.	No. of Certificates Given.
Bananas	25,802 cases	5,626
Oranges	6,543 "	1,422
Lemons	2,468 "	540
Cherries	10,672 "	1,826
Pineapples	2,054 "	1,190
Apples	19,974 "	2,817
Pears	69,440 "	4,825
Plums	8,076 "	1,466
Apricots	18,156 "	1,398
Peaches	5,652 "	1,095
Grapes	7,510 "	1,443
Tomatoes	1,180 "	208
Quinces	1,442 "	140
Passion Fruit ...	601 "	256
Gooseberries ...	1,043 "	88
Raspberries	26 buckets	10
Red Currants ...	6 cases	4
Nectarines	287 "	104
Figs	152 "	18
Loquats	42 "	30
Persimmons	26 "	23
Melons	29 "	14
Mixed Fruits ...	38 "	4
Cucumbers	1,026 "	188
Total	182,245	24,735

FRUIT INSPECTED FOR EXPORT TO UNITED KINGDOM AND FOREIGN COUNTRIES DURING 1901.

—	United Kingdom.	South Africa.	India.	China.	Singapore.
Apples	25,914	5,839	2,333	100	20
Pears	1,064	228	169	...	...
Grapes	378	...	...	...	...
Peaches	5	...	...	...	...
Quinces	1	...	...	...	...

Gross total, 36,051 cases, of which 33,087 were shipped under the bonus regulations.

PLANTS, ETC., INSPECTED FOR EXPORT IN 1901.

Number of packages inspected	3,658
Number of certificates given	3,332

SUMMARY OF FRUIT, PLANTS, ETC., EXAMINED FOR IMPORT AND EXPORT DURING 1901.

Imports under the Vegetation Diseases Act.

—	Number of Packages Passed.	Number of Packages Condemned.	Number of Certificates Given.
Fruit	844,698	8,173	8,453
Plants	467	...	365
Bulbs	156	...	98
Totals	845,321	8,173	8,906

Exports under Vegetation Diseases Act.

—	Number of Packages Passed.	Number of Certificates Given.
Fruit	182,245	24,735
Plants	3,658	3,332
Totals	185,903	28,067

FRUIT INSPECTED UNDER EXPORTED PRODUCTS ACT.

36,051 cases.

GROSS TOTALS FOR 1901.

Number of packages inspected	1,067,275
Number of packages condemned	8,173
Number of certificates given	36,973

THE FLAX-GROWING INDUSTRY.

By J. Knight.

In spite of all the efforts put forth within the last 30 years to popularize the growth of flax in this State, but little progress has been made, till quite recently, in the development of this important industry. In the old world flax has been a staple crop from time immemorial, for we find it mentioned by the earliest historians, and even now few plants are of greater utility to man. In face of the fact that a ready and profitable market exists for every gallon of oil or ton of fibre produced, at first sight it seems difficult to account for the apparent apathy of our farmers in regard to this industry.

Why Flax-growing has been Neglected.

Many attempts in cultivating flax were made on a small scale as a consequence of the assistance offered by the Government in 1873-4-5, and in some instances excellent samples of fibre were produced, but no commercial developments followed. Again, in response to the liberal bonus regulations of 1890, further efforts were made, but alike with unsatisfactory results. This was undoubtedly due to placing too much dependence upon old-world ideas. Many of these early attempts were made by men brought up in countries where certain methods were adopted, and working on these lines, though good samples of fibre or seed might be produced occasionally and in a small way, yet no real profit could be obtained. Finding the business unremunerative, some of these took to posing as authorities heaping ridicule on any who still expressed belief in the future of the industry.

The climatic conditions in many countries render necessary spring sowing of the seed, and the crops are harvested when in bloom by the laborious system of hand-pulling, and afterwards retted in water-holes, a most disagreeable practice. When we consider the tedious nature of these operations, and the difficulty of securing a sufficient number of hands for pulling, say 100 acres of crop, it will be seen that under these conditions the establishment of the industry was utterly impossible. It is a fact generally recognised that given skill on the part of the worker, machinery and .ppliances may be employed enabling highly-paid labour to compete successfully with even the serfs of Russia, and so long as this skill and these advantages arising from mechanical aids are possessed, we may rest assured of success.

From my own observations, I have no hesitation in asserting that the objectionable features of fibre production as practised in many countries such as hand-pulling and water-retting can be entirely dispensed with. Many instances may be cited where this has been done, but one is sufficient. Messrs. Wolff Bros. some years ago took up land in the Calignee hills, and commenced farming under great disabilities. When the flax bonus regulations came into force they determined to

embark upon the cultivation of this plant. Commencing with a few acres, no machinery, and but little capital, and burdened with the old world ideas about spring sowing, hand-pulling, and water-retting, it was only natural that at times they should become discouraged. But a capacity to think and the will to execute, carried them over their early difficulties, and now they have obtained a farm in a more convenient district, and equipped it with the most modern machinery, and in addition to devoting their whole time to this crop, also employ much outside labour. Many valuable facts and figures have been kindly supplied by them, and in discussing the value of flax as a farm crop, I cannot do better than draw largely on their experiences.

Will Flax-growing Pay?

In their new location at Tyers, near Traralgon, the Messrs. Wolff have about 120 acres under flax. The following statement of income and expenditure per acre will clearly show the profitable nature of the industry :—

Income.	£ s. d.	Expenditure.	£ s. d.
From 10 bushels linseed per acre	4 0 0	Rent per acre	1 10 0
,, 5 cwt. fibre	11 5 0	Cultivation and seed	1 5 0
		Harvesting (with binder) ...	1 0 0
	15 5 0	Threshing	0 12 6
	8 12 6	Spreading	0 7 6
		Drying and stacking (ready for	
Balance, profit per acre ...	£6 12 6	manufacture)	0 7 6
		Manufacturing	3 10 0
		Total	8 12 6

The gross returns from the 120 acres were over £1,800, exclusive of the bonus of £2 per acre for cultivating and £5 per ton on all fibre produced, in this case £1 5s. per acre. Including bonus, the gross returns per acre were £18 10s., or a total of £2,220, and net profit £9 17s. 6d. per acre, or £1,185 in all. Prior to entering into this industry the Messrs. Wolff were engaged in dairying, and though successful in that line, the profits obtainable, in their opinion, cannot be compared with those in flax-growing. Further extension of their enterprise has been decided upon, and the manufacture of linseed oil and oil-cake, for both of which there is a brisk local demand, will shortly engage their attention.

Soils and Localities suitable for Flax.

It is a difficult matter to say definitely what part of the State is most suitable for the crop, since it is found to do almost equally well in nearly all districts. The nature of the soil, however, is of some importance, it must be warm, dry, and free; cold wet soils should be avoided. A free soil is specially valuable, since, before sowing, the land must be well pulverized. Excellent results are obtained in the loose mallee lands when there is sufficient moisture for the growth of the plant. Generally it may be said that where a good crop of wheat can be obtained there also will flax do well, though wheat can stand a harder seed bed. In Gippsland and the coastal districts there is less

FIG. 1.—FLAX GROWN FOR SEED.

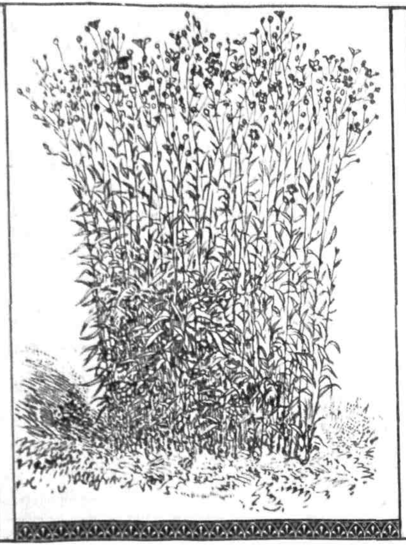


FIG. 2.—FLAX FOR FIBRE.

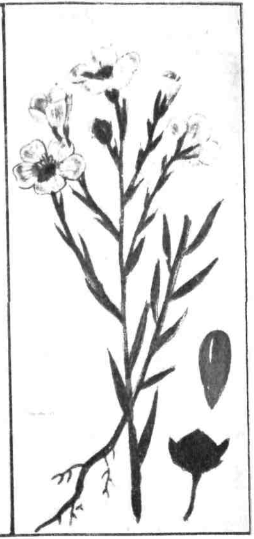


FIG. 3.—FLAX PLANT.

danger of growth being checked in the spring from want of moisture, and there is also a wider range of season for sowing.

Preparation of Soils.

No portion of the work pays better for attention than this. The seed requires a free soil to strike its roots down, as it is usually sown thickly, in order to produce tall, branchless stems. It has little or no room for lateral roots, and has to seek below, to a large extent, for its supplies. Hence, where the soil is indifferently prepared, the young plants suffer. The soil should be pulverized to the full depth of the ploughing, and whilst deep cultivation is to be recommended generally, it is not at all times advisable. There is nothing exceptional required by this plant when grown under ordinary conditions, but thorough cultivation must be given. The seed is small, and requires to be kept close to the surface, which is impossible without thorough pulverization. The advantage of this is felt in all the various after operations, and should not be lightly overlooked, which, unfortunately, is too frequently the case.

Varieties suitable for Cultivation.

There are many varieties in cultivation elsewhere, but only three distinct recognised kinds are grown in this State. The first is known as "Riga," another as "White-flowering Belgium," and the third "Large Red," or "Calcutta seed." This last is grown for oil making purposes only, whilst the two former are employed for both fibre and oil production.

The White-flowering Belgium is a spring variety, and is much more rapid in its growth, maturing a fortnight or three weeks earlier than either the Riga or Large Red; and whilst its yield of fibre may not be quite equal to the Riga, it nevertheless gives good returns when sown under proper conditions. One of its chief advantages is that of early maturing, as there is much danger with the late kinds, of attack by the boll worm, which pierces the seed pod, and totally destroys it. The experience of the Messrs. Wolff coincides with that of most others, that to be successful, the practice of spring sowing adopted in the old world must be abandoned, and the seed put in during autumn. They say "After sowing flax r' all times of the year, even as late as November, we have conclusively proved tha the early sown crop is the best, even when the spring is favorable." They have hitherto worked with the Riga, but are now giving the White flowering Belgium a trial. The Riga is usually employed in the flax-growing countries and is somewhat taller than the last named.

Seeding.

The amount of seed necessary per acre depends on the nature of the crop required. When grown for seed purposes only, much less is needed than if for fibre, and the plant is encouraged to throw out lateral branches and to develop seed (Fig. 1), whilst that grown for both fibre

and seed production is sown closely, in order to draw up the plant and give it length of stem, as shown in Fig. 2 of the accompanying plate.

The amount of seed required for fibre purposes is about one bushel, 56 lbs., whilst for seed only three-quarters of a bushel would be sufficient. Messrs. Wolff say—"For our purpose, that of making strong fibre, we find 60 lbs. of seed abundance, and this gives the best result when the crop is required for both seed and fibre. No doubt, in time, when a finer class of fibre is required, more seed may be necessary." The old system which was practised here and elsewhere, of sowing two and three bushels per acre, is a mistake.

Sowing.

The only method hitherto employed has been to sow broadcast by hand. Though drilling may be adopted for a seed crop, when fibre is wanted it must be sown broadcast. This does not preclude the use of machinery, as some drills are fitted so as to distribute the seed evenly over and on the surface. Their use would prove a great advantage, as there is no more difficult crop to sow satisfactorily. When unevenly sown, the produce is also uneven, the stems differ in size, and a coarse appearance is given to the whole fibre. No doubt machinery, when properly adjusted, will materially assist in preventing any defect of this kind. Those unacquainted with hand sowing will do well to mix the seed with dry earth or ashes, to give bulk, so that the seed will be less patchy, and more evenly distributed.

Time of Sowing.

It is impossible to lay down any hard and fast rule for the time of sowing, as the seasons vary, but it may be said that the proper time for sowing cereals, such as oats, and wheat, will be found to suit linseed. What should be aimed at is to get the young plants thoroughly established, but not too far advanced, before the winter sets in. If too forward, they are apt to throw out the bloom, or become heavy, and lodged. It cannot be fed off like wheat, when winter proud, hence, in seasons when the rains enable the ordinary farm crops to be put in early, it would be well to leave the linseed till the last. It is not injuriously affected by frost, as generally supposed, and no danger is to be feared from this source. Rapid growth is made in spring, but if checked for want of rain, the plants become stunted and short. More disappointments have been caused by spring sowing than all others, as our seasons are quite unsuitable for this. It has frequently been found that self-sown seed will produce excellent results, whereas a crop put in in the spring has been scarcely long enough to harvest. The growth must proceed unchecked, when once the spring has set in, and this cannot be relied on with late sowing under the conditions prevailing here. In humid districts such as Gippsland, there is a much wider range of season for sowing, and fair crops may generally be secured if put in even in July or August, but

May or June is much preferable, and in the northern areas the sowing should be completed before the end of June.

Covering the Seed.

Linseed, like most other small seeds, fails to germinate when deeply buried. Under such conditions many lie dormant in the soil, and when turned up by subsequent tillage, grow and become a nuisance. The soil should be brought to a fine tilth, the seed may then be sown on the surface, and a brush harrow drawn over it, or in some cases, a light roller answers the purpose, but where the soil is subject to crusting on the surface, rolling is not advisable, as it closes the pores, and prevents the air from permeating the soil.

Weeding.

Little can be done with this crop after it becomes advanced in growth, and where weeds, such as dock, thistles, wild turnips, &c., show themselves, they should be removed, as they not only cause a lot of unnecessary labour when treating the crop for fibre-making, but, to a certain extent, the sample is spoiled. Flax requires clean land ; in many cases new virgin soil is chosen on account of its freedom from weeds, and the plant adapts itself well to these conditions. As to its power to suppress ordinary weeds, it will do so when fairly established, but those referred to must be removed during the early stages of the plant's growth.

Stage of Ripeness for Harvesting.

This question seriously perplexes inexperienced growers. They are told that it must be taken when just past the blooming stage, and that, if allowed to go much beyond that, it is useless for fibre, and strange to say many writers lay this down as something which must be scrupulously observed. During the early stages of my labours in advocating the practice of securing a full crop of both seed and fibre, I met with considerable ridicule, and found it necessary to travel with samples of these products, and even then, in many cases, failed to convince the sceptical, as it was said that the fibre was valueless. Trade samples of fibre were then secured by our London agent, and when submitted to these critics they invariably, but unknowingly, reversed their decision by selecting the local article as better.

That seed and fibre can be secured from the same crop has been proved over and over again. Messrs. Wolff say—"To obtain the best sample of seed, the crop should be fully ripe, and this will give—contrary to European precedent—an excellent fibre such as we have been putting on the market, realizing £45 per ton."

Upwards of 50 samples have been obtained from various sources, all of which are the produce of fully matured crops. I have met a few who still adhere to the opinion that cutting while in bloom is the proper course, but such men are not found in the fibre market.

Unfortunately, agricultural societies do much to maintain these erroneous notions. With good intentions they offer prizes and appoint judges who carry with them their old world prejudices.

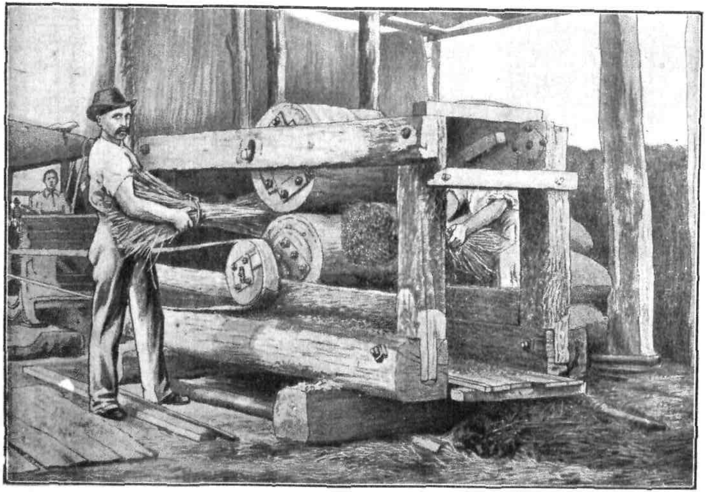
The plant matures its seed somewhat unevenly. The top seed bolls ripen first and open. When this stage is reached, the crop should be harvested without delay, and treated similarly to oats or wheat, and it is advisable to get it in stooks as soon as possible to avoid loss in seed. It will be found that the unripe bolls fill up considerably when in stook.

Mode of Harvesting.

One of the most difficult ancient notions to break down is in connexion with the harvesting operations. The recognised method is pulling up by the roots, and it is surprising what laboured arguments are put forth to prove that it is absolutely necessary and indispensable. It is said that the roots must be on or the oil escapes, or that the water gets in the stem; in fact, all sorts of troubles are predicted if it is done in any other way. Fortunately, success is achieved by the simple method of cutting with an ordinary reaper, or even with a reaper and binder, and further, where the land is properly prepared, the cutting is accomplished without loss of fibre, for no fibre exists in the roots, or for one or two inches of the lower portion of the stalk, and modern mowers are now made to cut so close that the stubble is scarcely noticeable. If the old system was necessary, it would be folly to advocate flax cultivation in this State, as the labour required is not available for what is at best a disagreeable task. Mr. Wolff adopts the system of cutting with a binder, and states that with the assistance of a man to take the sheaf from the machinery, the work is well done. Others prefer the ordinary mowing machine, with reaper attachments, as they state the best results are obtained by that means. This considerably simplifies flax cultivation, and renders it much more attractive. The after operations are the same as in other crops, the sheaves are stooked until dry, when they are stacked ready for threshing.

Threshing or Boll Crushing.

This operation is carried out in various ways. The old system of spreading out on the floor and bruising the bolls with a flat mallet is altogether too tedious, so also is the rippling, and the ordinary thresher is slow and expensive. The accompanying plate illustration shows Mr. Wolff's process, by which he states two men can treat two acres per day. The machine, as will be seen, consists of two short rollers, the upper resting on the lower one; they are kept in position by spindles; the lower one has a pulley on one end, on this the belt is attached, which is connected with the engine or horseworks. The spindle in the upper roller works in a slot, so as to admit of its rising and lowering when the sheaf is placed between. This, Mr. Wolff states, effects a considerable saving, and reduces the cost of extracting the seed to a minimum.



THRESHING OR BOLL CRUSHING.

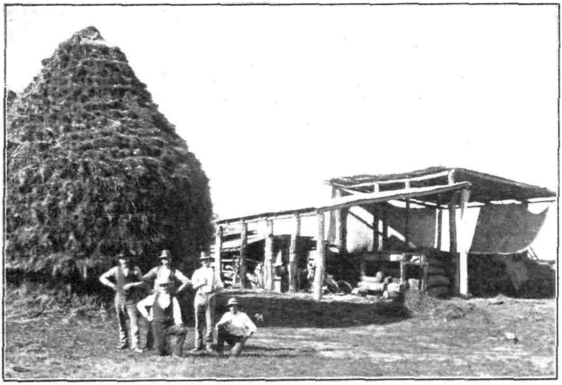


FIG. 5.—STACK.

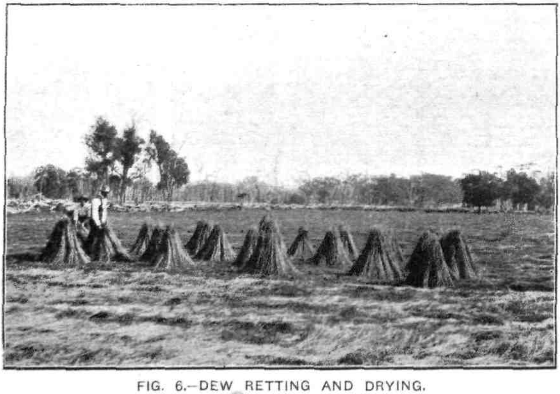


FIG. 6.—DEW RETTING AND DRYING.

The following illustration shows a machine much on the same principle, made by Messrs. Cliff and Bunting :—

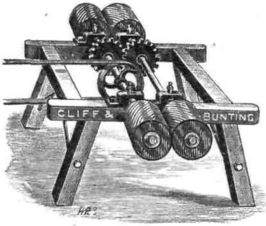


FIG. 4.—Thresher or Boll Crusher.

Some of these are now in use, and are said to work well. The seed is afterwards passed through a winnower, and easily cleaned.

It may be pointed out that the sheaves are not untied, and that the heads only pass through the rollers. In the case of Messrs. Wolff's machinery, the weight alone is sufficient to crush the bolls. In that of Cliff and Bunting, a spring is used to keep the two rollers together, and give the necessary pressure. After this the sheaves are stacked (Fig. 5).

Retting.

This is perhaps the most difficult operation to learn. It consists of rotting, or destroying the gum which binds the fibres to the woody portion of the plant, and it requires to be done in such a manner as to avoid the decaying process being carried so far as to affect the fibre. There are various methods by which this is accomplished. In European countries the straw is placed in water, sometimes running streams. In Ireland and other countries pits are used, which are considered by some to be an advantage. This system has been carried out in this State, but its disagreeable nature creates an unfavorable impression, as it gives off an offensive odour and pollutes any water-course into which the discharge is made. It is entirely unnecessary for the production of fibre, and is not to be recommended.

In the accompanying plate Fig. 6 shows the method adopted by Messrs. Wolff, which is known as dew-retting.

This is by no means a new process. It has been employed for ages past for both flax and hemp, but its application on a large scale in this State has been left to Messrs. Wolff Bros. Acres of ground are covered in the manner shown in the illustration. Messrs. Wolff state—"This method of retting flax, although simple and cheap, costing as it does about 15s. per acre, is the one operation which requires skill and care. If insufficiently retted it is difficult to treat, and if overdone the fibre is seriously injured, and its value reduced." The test is easily made, for as soon as the fibre separates freely from the inner or woody portion when broken, it may be considered

sufficiently far advanced to be removed, and when dried the decay is arrested; the material may then be stacked and treated as opportunity permits. The knowledge, with a little experience, is easily acquired.

Breaking and Scutching.

This consists of crushing the retted straw betwixt fluted rollers, and afterwards passing it through a beating, or brushing process. The first

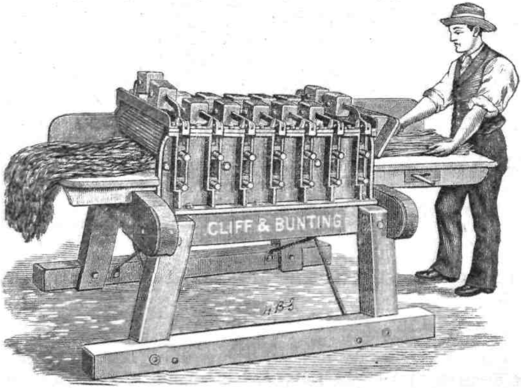


FIG. 7 —Breaker.

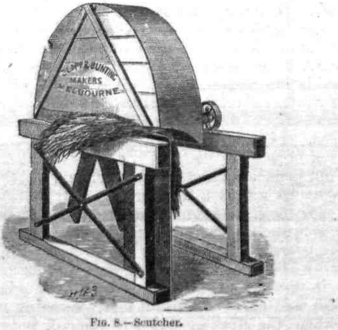
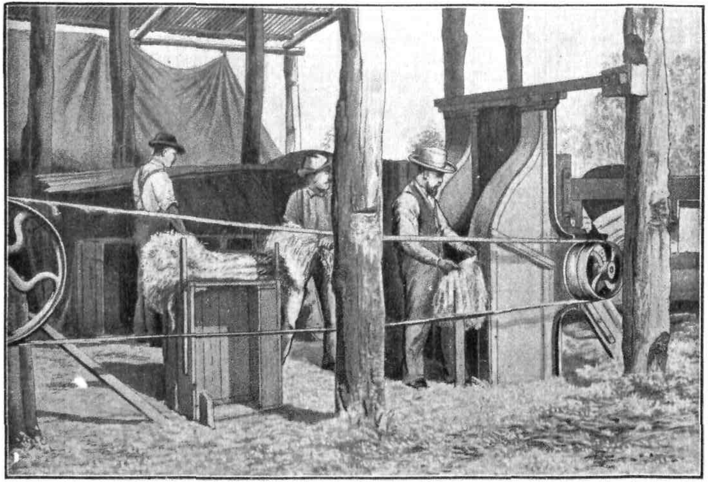


FIG. 8.—Scutcher.

operation breaks up the non-fibrous portion of the plant in short bits from a half to one inch in length, readily separated in the scutching.



MESSRS. WOLFF BROTHERS BREAKING AND SCUTCHING.

The whole of the machinery is driven by a small oil engine; a four-horse power being considered sufficient. The following illustration shows a factory as fitted up by Messrs. Cliff and Bunting:—

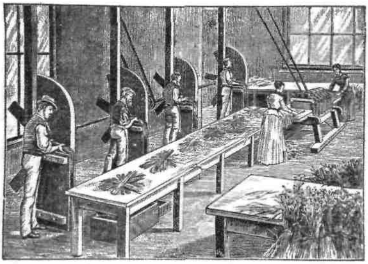


FIG. 9.—Interior of Flax Factory.

'The cost for machinery and fittings amounts to about £70, its capacity is said to be about 4 cwt. of dressed fibre per day.'

After passing through all the various stages, the fibre is put up in bales similar to wool packs, weighing from 4 to 5 cwt. each. The tow, which consists of broken, and out of place strands of fibre, is cleaned and served in a similar manner, and as the value of this is only about one-sixth of ordinary fibre, skill in manipulation is shown by reducing this to a minimum.

The Commercial Value of the Industry.

As regards the market for flax there is no need to look beyond our own State, as the local demand is more than we may reasonably hope to satisfy for some considerable time to come. The inducements offered by manufacturers show clearly a desire for a home supply. Messrs. Miller and Co. have for many years paid special attention to the development of flax-growing, and have imported the latest and most approved machinery to assist those engaged in the industry. They do not, of course, pretend to advise on questions relating to its growth and cultivation, but offer liberal concessions in regard to machinery required, and also are prepared to purchase the fibre at a price equal to or in advance of that given for the imported. Mr. Wolff says—"We are now receiving £45 per ton, and for the present are perfectly satisfied." Samples forwarded by Mr. Wolff to German and Irish mills have been so highly esteemed as to bring forth offers for the whole of the crop at prices even above those ruling locally.

It has been asserted in some quarters that flax-growing is a decadent industry, and that the fibre and oil have almost disappeared from the list of the great products of the world. The following figures relating to the consumption of fibre in Ireland are taken from the last

"Annual Report of the Flax Supply Association of Belfast," and will serve to show what amount of truth exists in this statement:—

Year.	Imports.	Irish Supply.	British Supply.	Total.
	Tons.	Tons.	Tons.	Tons.
1886	64,635	23,151	555	88,341
1896	95,199	10,844	269	106,312
1900	71,586	9,479	93	81,158
Average of last decade ...	87,907	11,199	225	99,331

The sources of supply may best be shown by the acreage under cultivation in various countries. These figures are from the same source, and are the latest available.

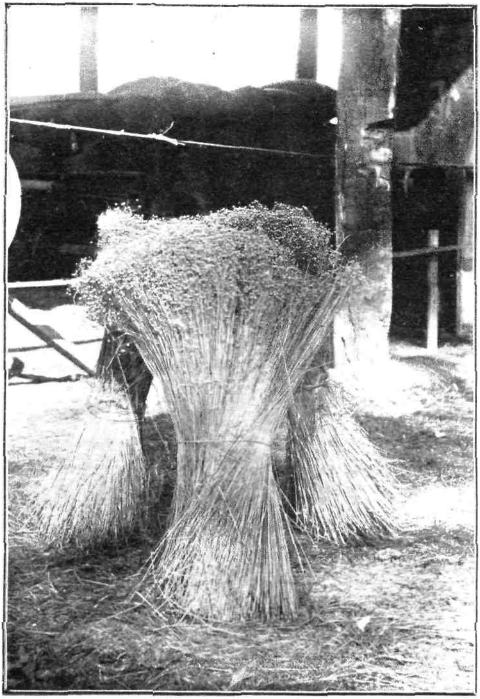
	Year.	Acreage.	Yield in Stones per acre.
Ireland	1900	47,451	31·96
Austria	"	177,067	44·74
Hungary	"	45,497	34·51
Belgium	1895	75,618	32·96
France	1899	43,457	45·73
Germany	1893	150,628	37·57
Holland	1899	20,113	38·99
Italy	1895	128,000	24·96
Norway	1898	4,169	—
Roumania	1898	62,876	—
Russia	1897	2,612,268	15·91

The exports of linen piece goods have averaged in value £3,689,000 in the last ten years, and of this trade a considerable proportion comes to Australia; in one item alone, linen thread, we import about £33,000 worth annually. The quantity of thread locally manufactured is small, and the bulk of the needed fibre has to be imported, but as soon as local supplies of fibre become available, the factories here are prepared to extend their operations, and also enter upon the production of canvas.

Conclusion.

We have seen that this industry is an important one; a fact recognised, not only in Victoria, but in other countries as well. In Ireland we find the associations there import teachers from Belgium to show the farmers the best means of treating the flax crop. In the report of 1900 we find it there stated that arrangements had been made for the introduction of an expert with machinery to travel the district shows, and give object lessons in its manipulation. When we consider that this is in one of the oldest and most extensive fibre-producing countries of the world, it is not unreasonable to suggest that something of a similar nature should be done here; but to introduce an inexperienced hand to the altogether foreign conditions would be to court failure. There is an abundance of evidence of this existing already. To be successful it will be necessary to adopt a system suited to present conditions, and this, coupled with the use of approved modern appliances, is all that is required.

The French Government is alive to this fact, and is now giving £1 5s. per acre as a bonus for flax cultivation. Russia is offering liberal concessions to those entering into the industry, but in a young country like this, with virgin soil, and a superior climate, the industry should flourish.



SHEAVES OF FLAX CUT BY REAPER AND BINDER.

TREES ON THE FARM.

By H. Pye.

One of the most striking features of the present-day scenery of many of the farming districts of our State is the general absence of well-cared-for plantations of shelter and timber trees. We are more familiar with the gaunt dead forest giants that stand like mystic sentinels of a glorious past. Farmers! cannot you, who are bound by every tie of gratitude to the trees for their kindly shade during the hot noonday, and to their warm shelter from the cold winter blasts, do something to encourage the growing of them? Your influence at the Agricultural Societies' meetings and at your conferences would do much to forward the movement. Country teachers! instil into the minds of your pupils the love for trees. Do this, and you will encourage them to reflect, and save many from future mental stagnation.

A farmer generally aims at obtaining from his land the best returns possible, but it sometimes happens that portions of his farm are of no agricultural value, and these may be profitably planted with forest trees. In setting out these trees, he will have three objects in view. Firstly, that they may serve as a wind-break for the shelter of his stock; secondly, as a good investment; and, thirdly, as an ornament to his property. The forester has other aims, such as the amelioration of climate and the mitigating of the severity of floods.

The farmer settled on some wide exposed plain, with hot and cold winds sweeping over the land, envies the man whose good fortune enabled him to locate himself in a part of the country where belts of trees shield his stock from the cutting winds of winter and the scorching suns of summer.

Trees are nature's own means of protecting both beasts and birds from storms, and why do we not profit more from so grand a teacher, and apply the knowledge gained to practical account? Where shelter is absent it seems to be the farmer's imperative duty to protect his crops, fruit-trees, stock and buildings by planting suitable trees. Only those suitable to the locality and soil should be planted. It is not advisable for farmers to experiment with trees which may afterwards prove totally unsuitable. The forestry department has most likely done some useful work in testing the fitness of trees for the different parts of the State, and so has formed some data to go upon, and which, if published, would arouse a good deal of interest among the farming community. Observations should be made of trees both introduced and native which may be growing in the vicinity, and those that prove suitable to the soil and climate may be planted and grown with success.

A tree may serve two or more purposes. It may be useful as a wind-break, and later on may be suitable for timber, or it may be valuable even for firewood. The planting of trees is one of the simplest means the farmer has of beautifying his home, and visitors get a good impression of the place and the country. This is not merely a

poetical feeling; the first impressions given to a person are important, and in selling a property ofttimes a little sentiment decides the transaction.

The mistakes of planting trees too close to the house and to each other are common. In the former case, the water-spouts on the roof get filled with leaves, and many of the latter find their way into the tanks, to the detriment of the water. Besides, the trees often throw too deep shadows on the house and render the rooms unnecessarily dark. When the trees are too thickly planted they rush up thin and gaunt-looking, and shut out the sunlight both in winter and summer, especially when pines and other evergreens are used.

Tree-planting is of so much importance, that it may be worth while for the Government to offer inducements to farmers to plant largely of forest trees, by having their properties rated on a lower scale than usual, so long as the plantation is kept in good order, and there is a prospect of some good timber being secured. When the timber is ready for felling, it may be arranged, as is done in other parts of the world, that the State should receive the first right of refusal when it is ready to be sold. A bonus is not advisable, since, when properties change hands, the interest in the plantation may not be sustained, but if it be a question of lower rates, it would be to the occupier's interest to protect the trees. Again, it may be a wise provision, when selling land for closer settlement, that a clause be inserted in the conditions of sale that a certain number of useful trees be planted and properly attended to. This would specially apply to the States of the Commonwealth that still own a large area of land.

The scarcity of suitable timber for many purposes often causes iron to be used instead, where the lighter material may be more suitable and cheaper. The benefit derived from one farmer, who may only plant two or three hundred trees, is not great, but that derived from the combined efforts of ten thousand farmers or more would be very appreciable.

Neither the brows of the hills nor their steep weather-sides should be denuded of their natural vegetation, or great gullies may be formed, and valuable soils washed away. For shelter purposes it may be necessary to plant rapid-growing trees, but such trees rarely supply good timber, and they are generally short lived, hence the advantage of growing in conjunction with the former some of the slower-growing though better timber trees. It would be as well when planting trees around a garden or a cultivation field, to choose those species that are not voracious feeders, otherwise the plants and crops in their immediate vicinity will become stunted, and probably die away towards the end of spring. At the College Farm there is a row of trees, principally sugar gums and silky oaks, bounding one side of a field. The crops growing in the field become very stunted fully twenty yards from the sugar gums, but grow well to within a few feet of the Grevilleas or silky oaks.

For the poultry yard, trees of a shrubby nature are the most suitable, as they offer a good deal of shade in summer and protection from cold winds. There is no doubt but that without such trees or equivalent shelter, to act as wind-breaks during winter, the farmers' hens make

poor records as winter layers, when the price of eggs is at the highest. They must have warmth if the food supplied to them is to give profitable returns; and I know from experience that the profitableness or otherwise of poultry rearing and egg production are in a great measure due to not attending to the above important matter. The farmer knows from experience that as soon as the cold weather sets in his cows are less profitable, even though they receive the same amount of food as usual; but as soon as he provides warm shelter for his herd, milk production is increased, and the cows not in profit put on more fat. The fat may be compared to so much potential energy that remains as such, until during the depth of winter when feed is scarcer and the thermometer is lower, this stored-up energy is utilized in keeping up the body heat.

The land to be planted with trees should be ploughed and subsoiled a foot deep, and this especially in the northern areas of the State. It should be well cultivated in order that a good seed-bed should be formed. Seedlings or other young plants should be first laid out in rows like vines so that weeding and cultivation may be facilitated. In planting it is essential that the roots be not exposed, especially those of pines and other evergreens. The surface soil must be frequently hoed and weeds be kept down; then no artificial watering will probably be necessary.

Many trees, notably the willow, poplar, tamarisk, plane, and the cork-barked elm grow readily from cuttings put in during the autumn. Oaks, pines, cypresses, and a host of other trees not easily or not at all propagated from cuttings, are raised from seeds, while the majority of trees may be increased by layers, although usually good shapely trees are not grown from the latter process. Grafting or budding has also to be adopted in the propagation of many of the choicer kinds.

Every young tree should be encouraged to develop a strong leading shoot, and to obtain this, lateral branches may be required to be cut away and the central shoot tied to a stake. Thickly planted trees prune themselves as the side shoots die away, owing to the lack of light and air.

Both the oriental and occidental planes thrive well in most parts of Victoria, especially in the northerly districts where some fine specimens may be seen, notably at Tabilk and Benalla, and possibly other places. Being deciduous, their falling leaves in the autumn make a litter, but the decayed foliage assists in fertilizing the land. The wood of the Oriental plane is superior to that of the western species, but is less suitable for moist situations. The cork elm is hardy and affords useful timber, very durable in the presence of moisture. The pepper tree (*Schinus*) is a rapid grower, and is ornamental in appearance. It makes a pleasing contrast to conifers, gums, and broad-leaved trees; it may be used as a wide hedge, but it makes a fine standard tree if trained up to one stem. It is only propagated by seeds.

Poplars are fast growers; some have an erect habit of growth, and others are spreading; the Canadian and the silver species are the best of the latter. The silver poplars growing in the College plantation are making good progress, but sucker very much; however, those

growing in the hard uncultivated soil show no signs of suckering, but otherwise are making rapid headway. These trees are deciduous.

The silky oak (*Grevillea robusta*) succeeds well in the north. It has nice fern-like foliage and handsome blossoms, whilst its timber is useful in furniture-making. It is a fairly rapid grower, although it dees not seem to rob the soil of its moisture and nutriment as the gum trees do. It is only propagated by seeds.

The blue gum (*Eucalyptus globulus*) grows very rapidly here, but quickly dies out, whilst the sugar gum (*Eucalyptus corynocalyx*) proves to be much more hardy and a more suitable tree for the northern areas. The blossom of the latter furnishes a considerable quantity of honey of good quality almost every season. The timber is of fair quality only, and not equal to that from several other eucalypts. If the tree is not pollarded frequently it grows straight, and as the branches incline to break off readily, the tree becomes rather spindly. Those at the College that were eaten back by sheep and cattle are now the prettier trees, and afford a good shade.

The lemon-scented gum (*Eucalyptus citriodora*), with its sweet-smelling leaves and clean stem, seems to grow well in this district, though it does not reach a great height. All of the eucalypts are propagated from seeds, and as some of them, especially the blue gum, have a world-wide reputation for checking malarial diseases, the planting of them should be encouraged in unhealthy situations.

All the trees in the following list, most of which were planted in 1893, by Mr. W. Brown, the late principal, are making more or less progress :—

Juglans nigra	or	Black Walnut
* Pinus canariensis	"	Canary Pine
* Pinus Cembra	"	Zirbel Pine
* P. Coulteri	"	Great Coned Pine
* P. halepensis	"	Aleppo Pine
* P. Laricio	"	Black Austrian or Corsican Pine
* P. longifolia	"	Clear Pine
* P. pumilio	"	Mountain Pine
* P. pinaster	"	Cluster Pine
* P. pinea	"	Stone Pine
* P. ponderosa	"	Yellow Pitch Pine
P. sylvestris	"	Scotch Fir
* Platanus orientalis	"	Oriental or Maple-leaved Plane
* Populus alba	"	White Poplar
* P. tremula	"	Aspen
Pyrus Aucuparia	"	Rowan or Mountain Ash
Quercus alba	"	White Oak
Q. suber	"	Cork Oak
Q. virginiana	"	Live Oak
Rhus coriaria	"	Sumach
* Robinia Pseud-acacia	"	False or Locust Acacia
Salix alba	"	Huntingdon Willow
S. babylonica	"	Weeping Willow
S. viminalis	"	Common Osier
Sequoia sempervirens	"	Bastard Cedar
Syncarpia laurifolia	"	Turpentine tree
Taxodium distichum	"	Bald Cypress
Thuya occidentalis	"	American Arbor-vitae
T. japonica	"	Japanese Arbor-vitae
T. orientalis	"	Chinese Arbor-vitae
* Ulmus campestris	"	Elm
* U. montana	"	Scotch or Mountain Elm.

Those marked with an asterisk appear to be thriving more rapidly than the others, but a few of the trees though of slower growth, look healthy and are ornamental, and lend a contrast to the long-leaved gums. These are the rowan with its beautiful autumn leaves; sumach, a shrub like plant which is useful as a tannage; the cork and live oaks with their clean looking evergreen foliage, and the turpentine tree, of Queensland and New South Wales, which seems to thrive well, and is very ornamental.

The Currajong of New South Wales is a rather pretty tree that grows here, and a few specimens of it about lend a pleasant contrast to the pines.

A good many more trees could be added to the list by the Forestry Department, and if inquiries were made, there is no doubt but that the Conservator of Forests would give the benefit of his experience to those who would write to him for advice.

The Osage orange is a deciduous tree that makes a pretty hedge, and when grown as a standard on a single stem makes a handsome tree. It is quite hardy and will grow from 20 to 30 feet high. I saw a good specimen of this tree at Mooroopna. At the College it is grown as a hedge, but I intend to plant out a few specimens as shade trees.

Of the flowering shrubs the various species of Oleander appear remarkably hardy, but otherwise than ornamental plants they are of no use to the farmer. Of the trees of a more or less shrubby nature growing in the College plantations the carob (*Ceratonia siliqua*) is one of the handsomest and most useful of the evergreens. It is a rather slow grower, but has much to recommend it to the notice of farmers. It is usually propagated from seeds, and as the male and female flowers grow on separate trees, if the beans are wanted for feed, the majority of the seedlings should be grafted with scions from the best female trees growing near, and a few worked with scions from the male trees. If the farmer is not particular whether the trees are fruit-bearing or not, he can plant out the seedlings when young in their permanent positions. These shrubs may be propagated by layering and cuttings; the latter need bottom heat in order to be successful in striking them. The ripe fruit is a long sweet bean, which when ground up is used as a condiment for cattle. The green bean is very astringent, and is not fit to eat. The seed is a small, hard one, and is said to have been used in the weighing of gems, as its weight was thought to be fairly constant, hence the term carat, the shrub being also known as the carat bean, locust bean, and St. John's bean.

The Irish strawberry (*Arbutus Unedo*) is a shrub-like tree smaller than the last named, and succeeds well here. Its fruit is edible, and is sometimes used in jam and preserve making. It blossoms well, and is quite an ornament to the garden or shrubbery. It may be propagated from seeds, or the young plants may be purchased from the nurseryman.

Olive trees may be used for planting avenues or hedges. In the latter case they should be close together, only a few feet between each, much depending on the variety used. The larger trees for avenues may

be planted from 25 feet to 30 feet apart. The berries then could be utilized for making oil or preserving, and so prove profitable when the picking of the fruit can be carried out at the rate of about three shillings per hundredweight.

If farmers and others who have good specimens of special trees were to send notes to the Editor, I feel sure that he would be obliged for any trouble taken, and would give others the benefit of the information through the columns of the *Journal*.

PRACTICAL IRRIGATION.

By George Pagan.

A paper read at the First Annual Conference of the Victorian Farmers and Rural Producers Association, held at Shepparton, 3rd July, 1902.

As irrigation has been the subject of much discussion in Victoria for many years past, some account of the results achieved in the Goulburn Valley, will doubtless prove of interest to the farming community. Over the greater part of the northern districts of this State the rainfall in most seasons is too light to properly mature the crop, so the question arises whether such increased returns can be obtained by irrigation as will leave a profit to the farmer after paying all rates and charges and deducting the cost of the necessary labour. My own experience during the last twelve years with various crops and fodder plants will, I think, furnish an answer in the affirmative.

Lucerne.

Undoubtedly the best fodder plant for cultivation under irrigation is lucerne, since it is easy to manage, and gives the largest profit. The usual practice with us is to sow in the autumn with either wheat or oats for hay, using about 8 lbs. of seed per acre. On account of the smallness of the seed the land must be brought to a fine tilth, and to secure this the best plan is to water the land before ploughing, unless good autumn rains have fallen. The lucerne is sown on the surface before drilling in the grain, and as soon as the crop is taken off the water is applied, so as to thoroughly establish the plants and obtain a fair amount of feed the first season. In the following year the spring rains may generally be depended upon to induce good growth until January, when the first watering should be given. For grazing purposes, two irrigations in the season are sufficient, the first in the beginning of January, and the second early in March. After each watering the paddock should be left untouched for two weeks, in which time the plants will have grown to a height of about 14 inches, and will be commencing to bloom. The cattle may then be put on, generally one beast to the acre, and may be allowed to graze for about four weeks, when sheep are substituted for a fortnight, after which the water is again applied. Under these conditions large supplies of nutritious green feed are obtained for eight months in the year, that is from the beginning of September to the end of April. In my opinion, lucerne under irrigation tends to enrich the land, for I have found that the older the lucerne the better are the results. There does not appear to be any necessity for cultivation, since the constant watering keeps the plants healthy.

The monetary returns next demand consideration. The cost of the two waterings at 1s. each per acre is 2s., and labour of applying about the same, total 4s. per acre each season. As 2 acres will fatten a bullock the gross profit is £3, and after deducting the cost of irrigating the 2 acres, that is 8s., there remains a net profit of £2 12s. for the 2 acres, or £1 6s. per acre for the four months in which the lucerne is in full growth. A further advantage arises from the fact that without an artificial supply of water it would be impossible to fatten cattle during this period.

Cereals.

It may seem strange to some, but experience has proved conclusively that to produce the best yields of wheat and oats, one *watering only is required, and that is best given just before ploughing.* For barley a second application is often advisable to insure the proper filling of the grain and the production of a first class sample for malting purposes.

There are many advantages to be gained by irrigating before ploughing, not the least being that the work can be commenced in *good time without waiting for rain.* *Self-sown grain, wild oats,* and other weeds begin to grow immediately and can be turned under, which enables a clean crop to be obtained. Further, the land is easily worked, and a much more satisfactory seed bed is secured, the grain starts as soon as it is sown, and growth proceeds unchecked throughout the season.

To show the profits in irrigating wheat, it may be said that the average yield of non-irrigated crops is about 10 bushels per acre, which at 3s. per bushel gives a gross return of 30s. If irrigated once before ploughing 20 bushels can be depended on, worth 60s. per acre on the same basis. After deducting charges for water and labour in applying, £2 18s. remains, that is £1 9s. per acre more than from unirrigated land. If hay, oats, or barley were selected, the returns would be very similar.

Natural Grasses.

A good soaking applied to ordinary grass paddocks in February will give a splendid growth during the autumn months when succulent green feed is scarce. The grass moreover will be enabled to withstand successfully a dry winter, and under such conditions will come away much better in the spring. The profit here is less easily estimated but there is no question but that it pays handsomely.

Effect on the Value of Land.

I estimate that the construction of effective irrigation works fully doubles the value of the land, that is, land which was worth £5 per acre without irrigation would be worth £10 if irrigable. But to secure the benefit from this increased value it is necessary to make

use of the water for crops or lucerne. I believe it would pay the State well to borrow money for such purposes, and to show this, no better example could be given than the case of the Rodney Irrigation Trust. The irrigable area is about 230,000 acres and the cost of the trust's channels, that is exclusive of the national works on the Goulburn, was roughly about £1 per acre. This sum of £1 per acre would probably closely approach the actual cost of channel construction in other schemes in favorable country. As I have shown that the works would double the value of the land, the liability of £1 per acre, that is 1s. per acre per annum, would not prove a heavy burden. On this basis to make a scheme self-supporting the trust should be prepared to pay 1s. per acre per annum for the whole of the area within its boundaries, which in view of the profitable results from irrigation is not too much to expect. As to the question of whether sufficient water exists in the Goulburn and Murray Rivers to irrigate all our valleys it seems to me that if the winter rains were conserved ample supplies could be obtained to meet all requirements.

THE IRRIGATION OF CEREALS.

The severity of the long-continued drought, and the indifferent prospects of the coming wheat harvest have naturally directed more attention to the possibilities of irrigation as a means of increasing the wheat yield. Unfortunately, so far, the use made of the bountiful supply of water available in some of the irrigation areas has been much below the anticipations that were formed when the works were projected. But it must be admitted that the introduction of new methods in any branch of farming, and especially in wheat-growing, is always a very slow process. The truth in the saying that "Hope springs eternal in the human breast" is perhaps responsible more than anything else for the disinclination exhibited by many farmers to insure good wheat crops by irrigating before ploughing. The farmer is essentially hopeful; the old hand has seen so many startling changes that his memory can always supply him with reminiscences of a time when the outlook was at least as bad, and yet the ultimate results proved fairly satisfactory. It is no wonder, then, that when the rain does not come in March he still trusts to a good fall in April, and, though disappointed then, he pins his faith to a break in May, and so the best season for irrigating passes away without the land receiving any water. The only man who is not liable to err in his judgment in this way is he, who by actual experience has learnt how to double his wheat yield and to preserve his peace of mind. To such a one, of course, the use of the water is as much a part of the ordinary work as the ploughing itself.

The financial aspect of wheat-growing under irrigation is ably dealt with in the current issue by a farmer of great experience in the Goulburn Valley, Mr. Geo. Pagan, and the most successful and economical methods briefly sketched. But it must not be inferred, that because the plan of irrigating before ploughing which all who have had any experience emphatically declare to be the best, is therefore the only profitable one. It is not too late even now, where water is available, to mitigate some of the evil effects of the long-continued dry weather, in so far as the crops sown without irrigation are concerned. These may be greatly improved by watering during the spring. Indeed, in some parts of America, it is the practice to give as much as three irrigations to a crop of wheat—one before the sowing, a second at the beginning of spring, and the last just as the grain is coming into the milk stage. Care must be taken not to apply the water too late, as there is then a tendency to the production of a soft grain highly objectionable to millers. A strong prejudice against irrigated wheat was created a few years ago by this practice of late watering, which is largely responsible for the disrepute into which spring irrigation has fallen. It is not to be denied, however, that by far the best results are obtainable by the use of the water before the ploughing is done.

Cereals under Irrigation in Arizona, U.S.A.

Some interesting particulars relating to this subject appear in a recent *Bulletin of the Arizona State Experiment Station*, from the pen of A. J. McClatchie. The rainfall at the station in the first place is very much less than in any of the cereal growing districts of this State, amounting on the average to 7·18 inches a year, of which only 1·16 inches falls in the months equivalent to September to December with us. The practice considered the best in Arizona is to irrigate before the ploughing, just what our local experience has proved. Flooding is the method usually adopted, but experiments have shown conclusively that, where land is soft enough to furrow out, this the better plan. The furrows should be made 2 or 3 feet apart, the distance depending on the nature of the soil and the length of the field. The more slowly the water is absorbed and the shorter the field, the closer together must they be placed. In a country such as Arizona, where it is recognised that the amount of available irrigation water will always be less than the demand, there is a considerable advantage in the furrow method, as it requires less water. In addition, less labour in supervision is necessary, and the caking of the surface that follows flooding is avoided, though where the soil is too hard to permit the furrowing, resort must be had to the other less desirable practice.

Where the land is ploughed dry and irrigated just after the sowing, the results are not nearly as good as in irrigation before ploughing; and here again local experience is fully borne out. In the former case the land soon cakes and the evaporation is very rapid, and, as a consequence, early and heavy waterings are rendered necessary; but if the seed is sown in the artificially moistened seed-bed, there is usually no need to irrigate for two or three months even in that dry climate. During the growing season water as a rule is applied at a period equivalent to September with us, and again just as the grain begins to form in the ear. Some attempts were made to ascertain the relative yields obtainable by these two systems, and it was found that the crop watered before sowing gave about one-seventh more grain than the one not irrigated till after it was sown, and, further, the latter required fully one-seventh more water to bring it properly to maturity.

DAIRYING.

FODDER FOR THE DAIRY HERD.

PART II.

By T. Cherry, M.D., M.S.

In the June number of this journal an outline was given of the relative value of food stuffs and of the methods by which these values could be readily computed. It is now proposed to show how this information, combined with a knowledge of the value of barnyard manure, can be directly applied by every farmer to increase the milk yield of his herd. By this means the dairying industry will be placed upon a basis of permanent prosperity, and, as will be seen, this is the only way in which the industry can be made self-supporting in the proper sense of the term.

We have already pointed out the value of the nitrogenous or proteid constituents of the food. The ease with which the requisite amount of protein can be raised is the true measure of the fertility of the farm. Plants obtain all their carbonaceous constituents, such as sugar and starch, oils and fats, from the carbonic acid gas of the atmosphere. But for the elaboration of protein the materials must be drawn from the soil. These materials are nitric acid, ammonia, phosphates, and sulphates. They form the most valuable constituents of manure whether artificial or collected on the farm. These are the portions of the fertility of the soil which are sold with the crop. When all the crops raised on a farm are fed to animals, comparatively little of the fertility of the land is lost. It is estimated that one-fourth of the value of a crop of wheat and one-third of the value of a crop of oaten hay are drawn from the land. In selling such crops the capital value of the land steadily diminishes. On the other hand, when the produce of the farm is sold in the form of cream the case is entirely different. The butter fat is produced by the cow from materials derived by the plants from the atmosphere, and the portion of the milk drawn from the soil remains in the skim milk. The secretion of milk by the udder is not in any sense a process of filtration. Every particle of milk is elaborated by the living cells of the animal, which are rapidly worn out in the process. These cells can only be renewed by the protein elements of the food, and hence the importance of this class of the chemical constituents of the food.

In the cow, as in all other warm-blooded animals, most of the food is used up in maintaining the warmth of the body. It is estimated that 75 per cent. of the heat producing value of the food is annually consumed in this way. In the cold weather the proportion is much greater. The maintenance of life being the prime end to which the food is devoted, it follows that the cow must be receiving a full ration, or else there will be very little left for her to turn into milk. This fact

can hardly be emphasized too strongly. It follows that in the winter the milk yield can be increased by two methods—either by increasing the food or by keeping the animal warm. Every one must have observed how the cows select a sheltered corner of the paddock for a camping ground. If they have the opportunity they prefer dry, ploughed ground, sheltered from the wind or frost. The records of every butter factory demonstrate that adverse weather is the chief factor in accounting for the falling off in the milk yield. The milk supplied is not only deficient in quantity, but very poor in quality. The cow has been burning up the sugar and fat in her own body in order to keep herself warm.

Of the various methods of providing shelter for the herd, none can compare with housing them in a warm well-ventilated stable. A large shovelful of dry earth daily will make the floor much warmer, and absorb the liquid portion of the manure. Of bedding materials, young bracken forms one of the warmest and, from the chemical point of view, one of the richest of available materials. On most farms bracken grows only too readily, and its use for bedding will benefit the farm in more ways than one. Barnyard manure, consisting of the excrements of the cow mixed with bracken, and the above proportion of earth, has the following average chemical composition, the most valuable part being derived from the urine :—

COMPOSITION OF BARNYARD MANURE.

Moisture	73·0	to 77·5	per cent.
Nitrogen	·78	,, ·34	,,
Phosphoric Acid	·40	,, ·16	,,
Potash	·84	,, ·40	,,

Calculated at the current market rates for nitrates, potash, and phosphates, its value varies from 7s. 6d. to 10s. per ton. It is estimated that each cow will produce a ton of this manure a month if bedded every night and housed during the greater part of the day when the weather is bleak and wet. When thus furnished with a large quantity of valuable manure, the farmer has the means at hand for growing all the food stuff necessary to keep up the full yield of milk all the year round. Of still greater importance is the fact that he can raise heavy crops of roots, maize, and green fodder, and thus make the rations of the cow appetising and digestible, enabling her to secure the full value of the dry portion of her food. We have already pointed out that the rich young herbage of the spring is the ideal food for the milch cow. The more nearly we can imitate this the better the results will be. The importance, therefore, of succulent food is readily explained.

In order to secure the full value of the barnyard manure, a small area of land, say an acre for every four cows, should be kept constantly cultivated. As fast as the crops are taken off one strip of it, this should be at once manured at the rate of ten to fifteen loads to the acre, and a fresh crop put in. The chief source of loss in farm yard manure is exposure to the air. Fermentation takes place, the ammonia evaporates into the atmosphere, the nitrates and phosphates are washed away by the rain. When once the manure is buried in the

field its fertilizing constituents have been secured. Another important point about farm yard manure is that it improves the mechanical condition of the soil. Light soils are compacted and rendered more retentive of moisture; heavy soils are loosened and aerated. By this means land of almost any description can be made capable of bearing a succession of heavy crops. The more it is cultivated the richer it becomes. The crops which are to be grown for the cows vary in different districts. The requirements of the herd should be considered six months in advance, and a rotation of crops sown in their proper season. In nearly every part of this State oats or barley with tares may be sown in the autumn, followed by peas and beans, and these by mangels. In the spring maize, cow peas, and soy beans have proved of the greatest value on the American experimental stations. If with these is conjoined an area of oaten hay capable of yielding half-a-ton for each cow, and a quarter of an acre of lucerne, ample provision has been made for supplementing the natural pasture grass.

The only point which remains to be considered is the difficulty of providing water for the growing crops in summer. On many farms considerable areas may be watered by gravitation or by pumping from a creek if the site of the cultivation paddock is chosen with this purpose in view. The equivalent of three and a half inches of rain per acre may be provided (after allowing an ample margin for evaporation) by a dam containing 600 cubic yards of water. The advantage of being able to keep maize and lucerne growing at the period when their growth is most rapid is very great. Every farmer should aim at making the necessary provision, and the work may well be done in sections, the capacity of the dams being increased from year to year. The surplus grasses of the spring may be turned into ensilage instead of being allowed to go to waste and a crop of maize, planted in September or October, will in most years arrive at the necessary point of maturity without irrigation.

Ensilage.

Three methods are adopted of making ensilage, the stack, the pit, and the over-ground silo. Whenever a green crop is thrown together in a heap, fermentation takes place. The aim of a successful system of ensilage is to control this fermentation and reduce it to a minimum. Fermentation is a process of combustion. Whenever a log of wood is burnt, or the body heat of an animal is maintained, or fermentation is set up, the heat is produced by the union of the carbon of the organic matter with the oxygen of the air, resulting in the formation of carbonic acid gas. In the case of ensilage the portion of the material which is thus lost is not the fibrous and woody parts of the plant, but the starches and sugars which form the most valuable food constituents of the crop. In stack and pit ensilage the loss amounts in most cases to from 15 to 25 per cent. of the nutritive materials of the whole. It will thus be seen that the saving of the sugars and starches is the chief point to be attained. The over-ground wooden silo, when properly

constructed, reduces this loss to from 5 to 10 per cent. From experience extending over many years the Americans have settled three points—

(*a*) That ensilage crops should be passed through the chaffcutter before packing in the silo.

(*b*) That the silo should be at least 25 feet high. It then requires no weights to be placed on the top.

(*c*) That maize is the most profitable crop to grow for ensilage. It gives by far the heaviest yield per acre, and, when cut at the right time and chaffed, no air is retained in the mass. The exclusion of the air is the main factor in preventing fermentation.

An over-ground silo, 14 feet in diameter, and 25 feet high, will hold about 70 tons. This quantity may be grown on 3 acres of land. It will feed 42 cows each at the rate of 40 lbs. per day for three months. A silo of this kind can be built in most districts for £15. The details of its construction will appear next month.

Conclusion.

It will be seen that the collection and careful use of the manure of the dairy herd is the key of the whole position. The falling off in milk can be obviated by conserving the warmth of the cow and feeding her up to spring level. The housing during the winter nights is the best protection against the cold, and thus economises food, while at the same time it furnishes the means for growing all the necessary crops. It is of no use to attempt to cultivate a large part of the farm. A small area should be kept in a high state of cultivation, and the chief efforts concentrated upon it alone. A farm of 100 acres, under existing methods, carries on an average less than 20 cows. If 5 acres of land be taken in hand as indicated, and a succession of three crops grown each year, the total amount of ploughing works out at 15 acres, representing, perhaps, one day's work in a fortnight. The three crops off the 5 acres should yield at least 200 tons of green fodder in the course of the twelve months, or about 65 lbs. per head every day of the year.

The time occupied in cleaning out the stable every morning is not greater than that which is at present wasted in hunting for the cows among the stumps and logs before daylight. The monetary returns of the new method will be at least double what the same farm now produces.

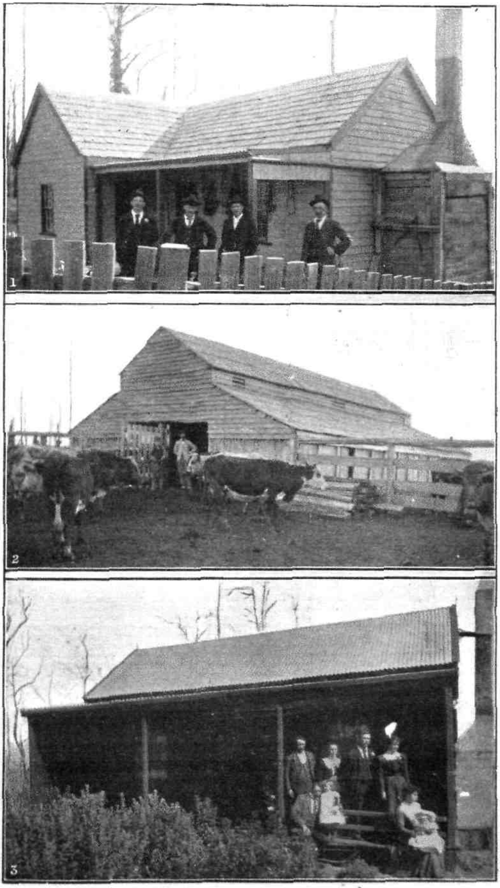
THE DAIRYING INDUSTRY IN VICTORIA.

By R. Crowe.

The vast extent and widespread ramification of the dairying industry in Victoria may be gauged by the fact that there are now 33,040 families actually engaged in it who own 483,560 dairy cows. This host of milking cattle demands the attention of over 40,000 milkers every night and morning. Viewing the splendid proportions the industry has attained, it cannot fail to be of interest to turn back the pages of time and trace its origin, history, and development.

The earliest recorded importation of cattle into this State was that made by Messrs. Hawdon and Gardiner, in December, 1836. Those aristocratic pioneers brought their cattle from Van Dieman's Land, *viâ* Sydney, travelled them overland and established a cattle station at Toorak. Desiring to celebrate Christmas time in good Old English fashion the primest bullock in the herd was killed for the occasion, but its toughness was the subject of general remark, and it was attributed chiefly to the long overland journey the cattle had undergone.

Lang's book on Phillip's Land states that in 1837 there were imported into Victoria 94 head of horned cattle, 47 head in 1838, 135 head in 1839, and 244 head in 1840 ; so that a little over 500 head of cattle were in the colony in 1840. We may fairly assume that some of them were used for dairying purposes. Dairying in Victoria, therefore, dates back to between 1838 and 1840. A few years subsequently, the oldest residents of to-day will remember that dairying was carried on somewhat extensively in the Central, Northern, North-Eastern, and Western districts. Amongst the early pioneers may be mentioned the names of Mr. Boadle, an early importer and breeder of pure shorthorns of the milking strain ; Messrs. A. O'Keefe, Michael Burke, Buchanan, and many others, who were obliged to manufacture butter in the old-fashioned way by setting the milk in dishes and churning by hand. They made such headway, and were so successful, that in the beginning of 1888 it is recorded that there was too much butter produced, and consequently prices had receded to from 3d. to 6d. per lb. By most cow-keepers this was not considered a serious matter, as dairy cattle were kept by them mainly for the purpose of procuring a domestic supply of milk and butter. Of course, in the spring, a surplus over home consumption was generally available, and it was sent to the local store and exchanged for goods. Seldom was cash received by the average butter producers. Such dairying, compared with the magnificent industry of to-day, was simply a subsidiary branch, enabling the farmer's wife in some instances to get clothes for the children in addition to groceries. In those days the farmer himself made his crops the object of his prime consideration, rarely condescending to recognise dairying at all. It will readily be perceived, therefore, that over-production was by no means a serious matter. If there was too much, well, it could be turned into axle grease ; at any rate fewer cows could be milked, and thus the supply could be limited to suit the demand. However, that was not universally the state of affairs, for many had



SETTLEMENT AT OTWAY FOREST.

1. Settler's Home. 2. Mr. McInnes' Milking Shed. 3. Mr. R. Torpey's Home.

embarked in the industry on a large scale. With them dairying was a leading feature, and to them low prices were proving so fatal that their enterprise had reached an acutely critical stage.

The First Butter Shipments.

It was at this juncture that a gentleman came to the front to whom Victoria owes a great debt of gratitude—the late Mr. David Wilson. On the 18th June, 1886, Mr. Wilson, in his evidence before the Royal Commission on Vegetable Products, referred to the modern dairy he had established in 1884, which was fitted up with an engine and a separator. He also alluded to an attempt made eighteen years before by 23 dairymen and himself, to ship butter to London. The result, he said, was disastrous—the stuff was sold for cart-grease. Undaunted by this failure, he made a very successful shipment in 1881. The butter was consigned in the s.s. *Protos*, which sailed in December of that year. It was made up in prints and sold at 138s. per cwt. in London. There were 38 tons of other dairy butter in the same boat which realized 8d. per pound against Mr. Wilson's return of 14¼d. Accordingly, a bright idea struck him. Butter of good quality, and even in character, might be exported on a large scale. Although the factory system had been tried successfully in New South Wales, little appears to have been known regarding it in Victoria until it was strongly recommended by one of our weekly journals of 3rd March, 1888. Credit is therefore due to the mother State for the introduction of the factory system, by means of which uniformity of quality was secured.

Introducing the Factory System.

The honour of introducing the factory system in Australia is due to the late Mr. T. S. Mort, of Messrs. Goldsbrough, Mort, and Co., the originator of the New South Wales Fresh Food and Ice Company, which started a factory at Mittagong in 1883. The first farmers co-operative butter factory, afterwards known as the Pioneer Butter Factory, was also organized by him, and started in March, 1884, at Kiama. Later, the farmers at Albion Park took the matter up themselves and succeeded in establishing a co-operative factory.

Victoria owes a great deal to Mr. Henry Patterson, manager of the New South Wales Fresh Food and Ice Company, and Mr. Henry H. Honey, manager of the Pioneer Dairy Company, for the valuable information they furnished to the Royal Commission on Vegetable Products on the 27th April, 1883. The Victorian factory system has been based on data then obtained. The National Agricultural Society, now the Royal, in conjunction with Mr. David Whitely, also merit commendation for their efforts to bring matters in this direction to a practical issue.

The First Butter Factories.

An announcement was made in April, 1888, that a cheese factory was about to be established at Cobden. As the expected supply was 1,000 gallons a day the promoters considered that by including

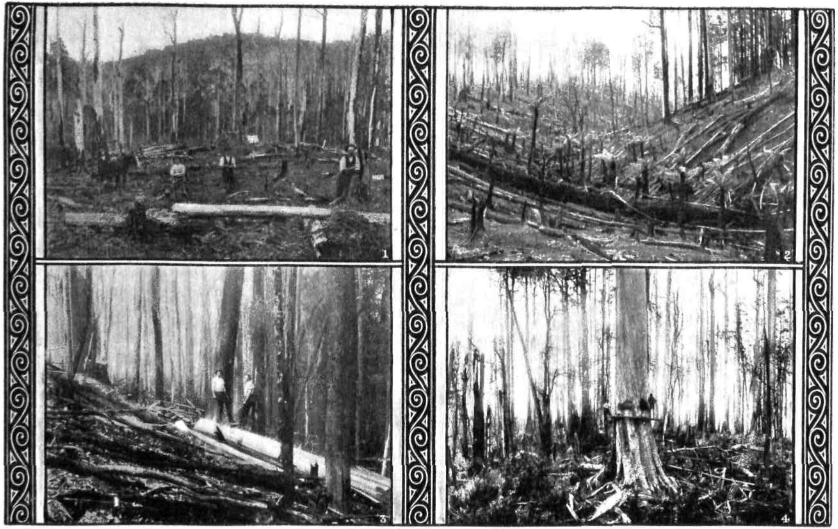
butter making the factory could be kept at work throughout the year. Whether it was the fear of flooding the market with the cheese produced from that thousand gallons which caused those pioneers to undertake butter-making as well, history sayeth not. When the building was completed, however, only a butter-making plant was put in, and operations were begun on the 10th October of the same year. Not one pound of cheese has ever been made there, as profits were realized from the start, and the company has enjoyed an uninterrupted career of success from then to now. Numbers of cheese factories were working with varying success before this, the Victorian Cheese and Butter Factory having been registered as a company on 15th September, 1882, to purchase and carry on the business of Mr. G. G. Pierce, Myrniong, near Bacchus Marsh. The next companies were respectively the Eddington, Appin, Bridgewater, Boort, and Jeetho, but as all these manufactured cheese only, Cobden must be credited with being the pioneer butter factory of Victoria. This honour is theirs by a few days only, as the Warrnambool factory began receiving and separating milk on the 26th October—16 days later—the Rosebrook Factory started early in January, 1889; Macorna, late in January; Koroit, on 2nd February; Thoona, 3rd February; and Tungamah in June of the same year.

Government Encouragement.

In April, 1888, the members of the National Agricultural Society interviewed the Hon. J. L. Dow, the then Minister of Agriculture, and requested a grant to equip a travelling dairy. Mr. Dow thanked the deputation for their valuable suggestion, and promised a sum of £5,000. However, a misunderstanding arose as to the terms on which the grant had been promised, and some time consequently elapsed before it was carried out. The Minister, with a broad practical grasp of the necessities of the time, diverted the operations into the truest and best channels. The Centennial International Exhibition was encouraged, and assisted in establishing a modern dairy, with Mr. D. Wilson in command. Every Agricultural Society in the State was asked to nominate one or two students from its district to attend and receive instruction at the school. Some 70 students were thus taught the use of the separator, and the modern system of butter and cheese making. Most of these afterwards were appointed managers of factories, and in turn spread the knowledge of the co-operative factory system.

It was in this season that the first factory butter was exported to London from Victoria, and a sum of £30,000 was set aside by the Government to provide a bonus on all factories and creameries established, and a differential bonus of £103,000 on their produce to encourage an export trade.

The bonuses gave a great fillip to the industry and brought into existence many factories and creameries in a very short time. Another factor which probably aided their introduction was the great difficulty the farmers had for some years in making both ends meet. The growing of potatoes, meat, and mutton had become very unprofitable, as the local demand was less than the supply, and there was, therefore, no profitable outlet for their surplus production. The equipment of



CLEARING LAND FOR DAIRYING, OTWAY FOREST.

1. Shingle Splitters.
2. Clearing for Homestead.
3. Felling Trees.
4. Clearing for Dairying

factories when first established was on a very modest scale as compared with the complete appointments of the present day. A building of 60 x 20 feet, with engine and boiler, a couple of 90-gallon separators, a small churn and butter worker, a set of scales, and a few butter pats comprised the outfit. Nowadays these structures, with their refrigerating machinery, pasteurizers, coolers, testers, cream vats, and well-equipped laboratories, are much more elaborate. I might specify the Euroa factory as a typical modern butter factory. The Colac and Koroit factories are examples of the gradual process of evolution which has taken place, as some portions of the original buildings still exist. The buildings themselves were added to year by year as the growth of their business demanded, until now the ever increasing area of dairying territory has necessitated the establishment of branches. The Colac company has now a branch at Cororooke, and will no doubt ere long open similar establishments at Beeac and Pirron-Yallock, both of which are large milk supplying centres belonging to and controlled by the Colac Dairying Company. The extent of this company's operations may be gauged from the fact that for the last two years the turnover has exceeded £100,000 per annum. The Warrnambool Butter Factory is also another instance of the progress that has been made. The directors some four years ago, realizing that their building and plant were out of date, took advantage of a slack season to raze them to the ground and replace them at considerable cost on substantial and up-to-date lines. This all proves that the directors of some of our butter factories are endeavouring to keep pace with the times. However, quite a large number of Victorian factories were originally built in an imperfect manner, and have now become so contaminated and dilapidated as to demand similarly bold and drastic treatment.

Educational Efforts.

Concurrently with Mr. Wilson's efforts at the Centennial Exhibition a travelling dairy was sent through the country districts to show farmers the modern system of cream separating and butter making. Mr. Wilson afterwards lectured to farmers in dairying centres, visiting those centres subsequently to inspect the creameries and factories established. For some years afterwards his teaching operations were restricted, and the only attempts at instruction were through the medium of the exhibition of modern dairying plants at work at the Wine, Grain, and Fruit Exhibition in 1892, the three exhibitions at Ballarat, as well as those at Hamilton, Geelong, and Bendigo.

Mr. Potts' labours are too well known to require specific description. His successor, Dr. Cherry, has already taken up his duties, and, besides travelling and giving lectures in the country on the science of dairying, he has a class at the Bacteriological Laboratory, over which he presides at the University. However, right through the entire period an important influence was exercised on manufacturers and producers from the export depôt, where butter as it comes forward for export has been analytically examined, and the faults discovered, pointed out to butter-makers, and remedies recommended for their

eradication. But the weak point in connexion with this always has been the inability of the staff to go out when required to impart to those who needed it the practical instruction necessary to enable them to improve the quality of their output. Last season, however, two dairy supervisors were appointed with the power of inspectors, and with a brief to act as instructors at the same time. The result of their efforts, combined with the supervision at the export depôt and the scientific education of the dairymen, is that the value of butter exported last season has been raised by over £18,000 sterling. A corresponding increase in quality and value may also be credited to that portion marketed locally. However, even with two dairy supervisers, one dairy instructor, and the manager of the export depôt, the staff available is far short of the needs of the time. In New Zealand, where the dairying industry has not assumed the dimensions it has in Victoria, the dairy commissioner has the co-operation of ten expert assistants. Some people may think I am ambitious to build up a large dairy staff, but when you come to consider that there are over 30,000 dairymen 237 butter factories and 372 creameries to visit and instruct, it takes a long time to complete the necessary rounds of visits. Although the two dairy supervisors commenced their duties last September, and only a superficial inspection is being made to ascertain the exact condition of affairs, and advise where needed, they, although constantly going, have not terminated their first round of inspection yet. If the work has to be done thoroughly and lasting good to be achieved, then they should stay in each district for a longer period than is now possible. This would mean, unless more assistance is rendered in this direction, that each locality can be visited less than once a year.

Selection of Dairy Stock.

The only safe rule to recognise in connexion with the selection of a breed of dairy cattle, is that in very hilly country, breeds light in weight should be chosen, such as the Jersey, Ayrshire, or Kerry; whilst on level country a wider range may be selected, and the milking strain of Shorthorns included. This is as regards the supply for butter production; but if in the neighbourhood of cities and district milk supply centres, the Holstein breed may be added. It is an axiom that begets like like, and a precaution that should not be ignored, is that a pure bred bull coming from sires and dams who have for two or three generations back proved their quality at the milking bucket should be selected. The old-time implicit reliance on long pure pedigrees is being discarded, and dairy farmers are now disposed to consider the actual returns per year rather than the length of the pedigree. Whilst taking every care in regard to the improvement of young cattle for future dairy stock, the pruning knife is constantly required; no matter what safeguards may be adopted in connexion with the breeding of a good dairy cow, disappointments are common, owing to the frequency of the appearance of faults inherited from ancestors preceding the grand sire or grand dam. The rule which has been found safest to follow by our most progressive dairymen is to weigh and record the

quantity and test the quality of milk given by each member of a herd. They learn to know definitely the annual return, and are guided accordingly. The progeny from good cows are kept to improve the standard of the herd, whilst indifferent cattle are fattened at the earliest opportunity and disposed of. I might quote numerous instances of people who, having adopted this system, have, in the course of a year or two, more than doubled their average annual return. However, dairymen are making satisfactory headway along this line, but matters of more importance at the moment are feeding and treatment.

Treatment.

It is becoming more and more recognised that dairy cattle deserve to be treated rationally, with kindness, regularity of milking, and provided with shelter at all times. There are many ways of furnishing shelter in the winter months. In some places hedges are provided, in others clumps of trees, while in districts where mixed farming is carried on, straw stacks are available. In a few instances shelter sheds have been provided, but probably the system which incurs the least expense, and which is most likely to be universally adopted, is that of rugging when desired. With regard to all these forms, each and every one of them is to be commended, but exception may be taken by some dairymen to the use of hedges and trees, on the ground that they create a harbour for sparrows. A cheap form of rug is recommended in one of the weekly journals by a Mr. Wylie, who made his own rugs out of two corn sacks, the cost of which he estimated at 3d. each, and a strap costing 3d., or a total of 9d. for the rug. He reports that after rugging, every one of his cows increased her yield and improved in condition. The produce was augmented to the extent of more than one-third, with a smaller quantity of food, and the effect on the cows themselves was marvellous—the quiet ones became more quiet and contented, and the nervous and irritable completely changed their nature, losing their nervousness and irascibility, and becoming perfectly quiet. His system was to keep a record of the outside temperatures, and when the thermometer went above 60 degrees he took the covers off, and when it fell below that he put them on, and kept them on always in wet weather. A very great number of dairymen in Victoria, it is pleasing to note, have also rugged their cattle with good results.

The Milking Machine.

The milking machine promises to overcome the most objectionable features of dairying, namely, long hours and constant labour. Recent trials of machines have, so far, proved eminently satisfactory. A large number of the "Lawrence-Kennedy" make are in practical use daily. The principle of their operation is very simple—a vacuum is created by means of an ejector on a steam-boiler; a tiny vacuum engine is worked on the lid of the can, in order to provide the pulsations necessary to imitate the action of the hand in milking or the calf in sucking. The "Hartnett" machine performs the task in a somewhat similar fashion, but as soon as the milk ceases to flow the cups automatically leave the

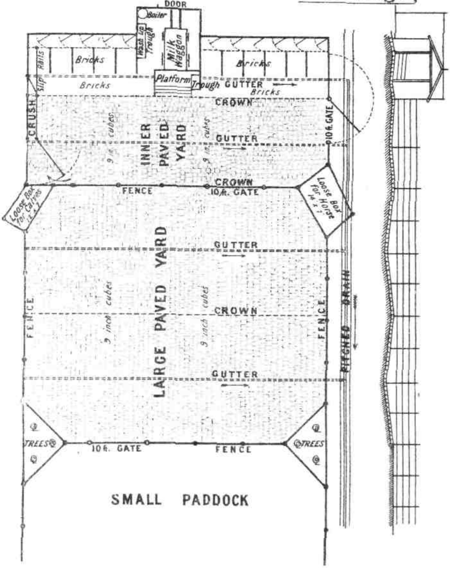
teats. In connexion with the use of these machines, it will always be necessary to check their work, and great care will have to be exercised in cleaning the tubes, so that the milk may not be contaminated and the quality impaired.

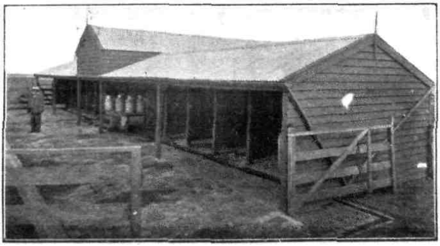
Prospects of the Industry.

Owing to the bringing of the land in Victoria into use for dairying, wherever suitable, the area is being increased every day. From the development which has been already mentioned it might, perhaps, be concluded that the Western district is fully prospected; such an inference, however, would be erroneous.

If we take the largest factory in that part and travel over 20 miles in any direction from it, we must come to the conclusion that dairying as it becomes more extended will result in an immense expansion of the business. A couple of months ago I drove to the Eurack Estate, recently purchased and subdivided by the Government for closer settlement purposes. At the time of my visit every acre was taken up by people who had gained experience, and in some cases already had herds of dairy cattle, and many possessed the means of turning the land into immediate profit. Although the country had been secured by them only a short time previously, they had then over 35 miles of fencing erected, and from a little eminence I counted 23 different houses in various stages of erection. Windmills were going up all round. In many parts of the Western district they are to be seen on all sides, and, in some instances, one in every two or three paddocks. They have their tall mills and short mills, lanky mills and dumpy ones, and some situated only a stone's throw away from one another. I have the recollection of a windmill being erected which took about a week to complete, but down there now some of the townships have two and even three windmill makers who undertake to supply the mill, tank, pump, and water-troughs. When an outfit is bargained for, they place the whole concern on a horse and dray, drive to the scene of operations in the morning with a lad to assist, and by three o'clock in the afternoon they have the whole arrangement in full working order. The Colac Company was busy at the time of my visit in erecting a creamery, the people were taking steps to have a new State school put up, a post-office was to follow, and by next season all these places will be in full swing. Twenty miles in the opposite direction from Colac the bursting up of estates is also going ahead, in this case, however, through the instrumentality of the squatters. South of Colac there is an immense territory in the Otway Forest yet to be cleared and brought into use. The rainfall in that neighbourhood reaches 40, and even 50, inches per year; the grass at the time was ankle deep. In many cases the people were busy forming dairy companies. At Beech Forest they were about to begin a butter factory, while at a place called Laver's Hill, further south, they were starting a cheese factory. There is a cheese factory in operation at Wangerrip. On the Gellibrand River there are two more cheese factories, and at Carlisle River a butter factory. The settlers are every year getting the upper hand of the forest, and this locality

—Plan of—
Mr. C. ARMSTRONG'S MILKING SHED AND YARD, Ondit Ridge.





VIEW OF MILKING SHED.

promises to be another South Gippsland. The country is well watered, every selection having two, three, or more springs constantly running through it. Further north, in the Coleraine and Casterton districts, considerable development is at the moment taking place. Down in Gippsland also dairying country is being opened up more and more each year. Away in the Upper Murray there are large areas yet to be utilized for this promising industry. The people in the Goulburn Valley, too, it will be seen, have undeveloped resources perhaps equalled by no other districts of the State in the shape of an unlimited supply of water, which they may use for irrigation. If this water be used to advantage—and it will be, more and more each year—then our dairying industry will reach a stage in the near future, let us hope, equal in importance to the present value of the whole of the other products of the soil put together.

(*To be continued.*)

THE TREATMENT OF THE COW.—HOW TO MILK, AND DAIRY MANAGEMENT.

A Lecture given to State School Teachers attending the Summer School, Training College, Melbourne, January, 1902.

By H. W. Potts.

(*Continued from page* 478.)

Preservatives.

A source of danger to our butter trade is the surreptitious introduction of a variety of substances into the milk supply to preserve it, particularly during the prevalence of hot weather. An inquiry addressed to a class of children in a dairying district will frequently elicit the fact that baking soda, sugar, salt, saltpetre, and the numerous preservatives found on the market, the most of which contain boric acid, are used to keep the milk in good condition. This is a reprehensible practice, and the teacher ought to impress this firmly on the minds of the pupils. As a rule, little regard is paid to the quantity of the preservatives used. Often much in excess of that really needed is added.

All such additions are injurious, not only as adulterants, but further, in the subsequent operations for converting the raw material into butter and cheese, these preservatives retard the development of desirable flavour and aroma, and lower the commercial returns. The temptation to resort to such practices in summer is doubtless very urgent. To avoid their use, however, demands increased vigilance and attention by the dairyman and his assistants.

Cleanliness and Coolness.

Cleanliness and coolness are nature's preservatives, and are the best means of preserving milk in a sweet, wholesome condition, most suitable for conversion into butter and cheese.

Throughout the operations, from the moment the milk leaves the udder until it is handed over to the consumer or manufacturer, too much care cannot be devoted towards excluding the invisible agents which create fermentative changes, and the chief factor to attain this is *scrupulous cleanliness* directed to the cow, the milker, the milk vessels, and the surrounding atmosphere. The other factor of equal urgency is coolness or low temperatures.

Storage.

When filled, the milk cans should be covered with clean butter cloth, and stored in a cool, clean, lime-washed, well lighted and ventilated dairy, situated at sufficient distance from milk-sheds, stables,

pig-styes, and fowl-yards so as to be surrounded with a sweet and pure atmosphere. The windows should be covered with close wire netting, with mesh sufficiently fine to exclude flies, moths, and other winged insects.

Warm milk or cream should never be added to cold. In every operation a thermometer ought to be used. The watchfulness exercised over temperatures is well repaid.

The dairy should be used solely for the storage of milk or cream.

The Cans.

Avoid cans that are rusty, dented, badly seamed, and loosely lidded.

The practice of tightening lids down with pieces of rag is objectionable, and usually results in providing means for tainting the milk.

Delivery.

In every instance milk should be delivered to the purchaser in a clean, well-springed vehicle, and at such a time as to secure the coolest delivery. When the sun is up, then the cans should be protected by canvas or calico coverings.

Biestings.

Colostrum, or biestings, is a form of milk which is always present in a newly-calved cow. This will last for five or six days after calving, and this milk on no consideration should be allowed to go to any butter or cheese factory.

Lime and Lime Water.

Few dairy folks have so far realized the beneficent influence of lime in the milking-shed and dairy. In this warm climate it is of great service in many phases of dairy life to preserve sweetness, suppress ili odours, check false fermentations, and secure sanitary conditions. It is odourless, and may be considered one of the most useful of our dairy disinfectants; in fact, it may be classified as our most wholesome, effective, and economical cleansing agent.

In its dry form, lime may be scattered on the floors of the milking-shed and dairy, in drains, or over the receiving yard.

The most serviceable method of utilizing lime, however, is in the form of *lime water*, which may be used indiscriminately, and with the utmost freedom. It is innocuous, or non-poisonous, and will not injure milk or cream in any degree. Lime is a necessary constituent of the hard and soft tissues of the body. Slaked lime is but sparingly soluble in water. A saturated solution is found only to contain 10 grains to the pint, or about a teaspoonful to a gallon of water, and this knowledge renders its preparation very simple in the dairy. No matter how much lime may be placed in a tank or cask and filled up, the water will only dissolve, absorb, or take up enough to form this saturated solution. Thus no apprehension need be felt as to its strength.

When the lime has been well stirred through the water, allow it to settle, when it becomes a clear, odourless solution, with an earthy, saline, or feebly caustic taste.

When the cask or tank is empty, fill it up again, stir well, and allow it to settle, and use as before. Eventually the lime becomes dissolved, or exhausted, and this can be detected by tasting the solution, when it will be noticed that it is losing its characteristic taste. This is the indication to add more lime.

The lime-water tank or cask is equally valuable in the milk-shed, dairy, creamery, or factory, and it is only a question of time when every dairyman and factory manager will recognise its usefulness. It should be used to finally rinse all dairy utensils and vessels, churns, workers, vats, floors, drains, &c.; in fact, wherever milk is used. It cleanses, sweetens, and destroys acidity, as well as acts as a wholesome disinfectant.

VITICULTURE.

SEASONABLE WORK IN THE CELLAR AND VINEYARD.

By R. Dubois, B.Sc.

SEPTEMBER.

Cellar.

The second normal racking and bottling should be finished before the spring equinox (22nd September). If through force of circumstances you are compelled to rack during the equinox, you should burn sufficient sulphur in the cask you are about to fill, to check any secondary fermentation.

The blending of different kinds of wine with the object of obtaining a uniform, characteristic and marketable article, should be done this month. This operation may easily be carried on while racking. Ventilation, cleanliness, and a cool temperature are at this time of the year, conducive to healthy wine.

Vineyard.

Layering, bench-grafting, and winter ploughing should be finished as early as possible.

Continue grafting of old stock. Use in preference scions previously stratified in sand, as these will knit more readily as explained elsewhere by Foëx.

Poorer kinds should be grafted to the better. Where late frosts are feared, vines should be planted out.

Collect sufficient stable manure, green grass, or dry leaves, and by placing these materials over dry straw or br hes, make heaps along the boundary of your vineyard. Should the temperature fall below freezing point during night, these heaps are lighted and an artificial cloud of dense smoke thus formed over the vineyard protecting it from injury. The fires should be lighted before sunrise, so as to have the whole vineyard covered with smoke when the sun is up. It is advisable to sprinkle the heaps of manure with water after lighting, as the protective effect of the smoke increases with the amount of moisture it contains.

Grafted cuttings are taken out of the callusing bed and planted in the nursery this month. As soon as winter ploughing is over, drive stakes and establish trellis. As soon as spring frosts are over, give a

second ploughing, throwing the sod towards the vines, to destroy weeds and keep the surface loose. It has been noticed that newly disturbed soil and soil covered with weeds are more favorable to the production of white frost, therefore, the winter ploughing should be done early enough to give time to the soil to settle again, and the second ploughing should be done after any danger of white frost is over.

Purchase bluestone, sulphur, and lime for mixtures against fungus diseases where these are prevalent.

Towards the end of the month the hibernating form of the phylloxera which has been in a torpid state during the winter, becomes active again, and lays eggs, giving rise to the first generation of wingless insects.

It is at this time of the year that the first galls appear on the leaves of American vines planted in phylloxera-infested ground.

THE PRODUCTION OF VARIETIES OF VINES.

By R. Dubois, B.Sc.

Vine varieties have been produced in two ways—(1) Accidentally, through nature's agencies ; (2) artificially by vignerons, horticulturists, or hybridizors. In the first case different kinds, growing side by side, were crossed by the pollen of the one being carried by the wind or insects on to the flower of the other. The seeds of the berries thus formed, falling on fertile ground, gave rise to new varieties. Those that were endowed with new qualities or characters attracted man's attention, and were propagated and improved by cultivation. The worthless ones were either destroyed or abandoned to their own fate. *Many crosses have taken place, and are daily taking place in this* natural manner in the forests of Africa, America, and Asia where the vine grows wild. Two very interesting and well-recorded cases of this accidental crossing are the Jacquez and Herbemont, crosses between three species—*V. vinifera*, *V. æstivalis*, and *V. cinerea*. When the vineyards of the Madeira Islands were destroyed, over 150 years ago, new vines were imported from Virginia and the Central States. Accidental hybridization was produced in the Madeira vineyards between imported American and indigenous vines, and these hybrids were subsequently imported by the colonists into the United States, where they have been in existence for over 100 years. From the United States they were imported into France some 30 years ago, when phylloxera first made its appearance.

In the second case, man makes use of either of the two following means :—

(1) Artificial crossing between two or more kinds, with the object of obtaining a new kind, blending the qualities of known varieties. This is called, by horticulturists, hybridization. The technique of hybridization is complicated, and the operation delicate. Its study would be out of place here, but we may later on publish a special article on this most interesting topic. Scores of varieties were obtained in this way, and the names of T. V. Munson and Franc, in America ; Bouschet, Millardet, de Grasset, and Conderc, in France, will always be remembered as those of men who have endowed viticulture with its most renowned and useful table grape and wine varieties.

(2) Fixing freaks often occurring on individual shoots, by propagating this shoot by layering, cutting, or grafting. This method of obtaining new varieties is easier, although uncontrollable by man. All wild varieties have black fruit and seeds, and all the seedless and white varieties of grape vines were obtained in this manner. They were at first freaks. Let us take one or two well-known examples. One of the most striking is the Parsley-leaved Chasselas. Not very many years ago a French vigneron noticed that the shoot of one of his Chasselas vines was carrying leaves totally different in appearance. When lignified, this shoot was propagated, and Parsley-leaved Chasselas created.

The Carmenère, a variation of Cabernet, with larger fruit, to be found mixed with the latter in most of our Victorian vineyards, was obtained in the same way. So were White and Brown Muscat from the Black, &c.

We may notice now in our vineyards, among the Gordo Blanco, shoots bearing bunches of perfectly seedless grapes. If these shoots were selected and propagated a new variety of seedless Gordo would be created, and prove of the greatest value for raisin-making.

There are now over 2,000 varieties of grape vines classified in the French Government collection of Fontainebleau, and their number is every year increasing.

THE PROTECTION OF VINEYARDS AGAINST SPRING FROSTS.

By R. Dubois, B.Sc.

Causes of Frosts.

Spring frosts are of two kinds—*black frosts* and *white frosts*—both of which affected our vineyards very severely during the spring of 1899, right into November, reducing the crop by one-half.

According to Foëx, black frosts are caused by a drop in the general temperature of the atmosphere, the ground being much colder than is the case with the latter. They usually occur before white frosts at the start of vegetation. When the atmosphere and soil are dry, and the thaw slow and progressive, little harm is done. When, on the other hand, the thaw is rapid, the shoots dry and the buds die. Black frosts often produce swellings or excrescences on the larger roots, the collar, or even the base of the spurs, which should be shaved off when pruning, as explained in Seasonable Work for July.

Spurs, and frequently arms, wither away, and in this case the effect of frost is felt for many years, and stumps have to be cut back and brought into shape again. This occurred with many vines frost-bitten in 1899, which are only now recovering their normal shape.

White frosts are produced by the cooling of the soil, resulting from the radiation of the heat from the soil towards the sky during still and clear nights. This may easily be ascertained by tying two thermometers to a stake 6 feet high, one touching the surface of the soil, the other on top of the stake. In many cases it will be found that there is a difference of 10 or 15 degrees between the two thermometers, the temperature being, say, 30 degrees on the soil level and 40 degrees or 45 degrees 6 feet higher. The young shoots close to the soil die if the temperature falls below freezing and rises suddenly under the action of the ascending sun. It is towards four or five in the morning that the cold is most intense.

Means of Protection.

The only way of diminishing the effects of black frost is to throw back the bursting of the buds, by pruning very late, applying fall pruning, or destroying part of the root system with a subsoiler as explained in the June issue.

These methods are also effective against white frosts, but other means are used of which the most beneficial and less costly is the production of an artificial cloud of smoke, which, however, is worthless when the temperature falls below 28 degrees.

Smoke is produced in various ways. Stable manure, cow dung, green grass or dead leaves are placed on heaps of dry straw and disposed regularly throughout the vineyard 2 or 3 chains apart. The straw is lighted and the heaps sprinkled with water. Another very good way, which obtains in the south of France, where manure is

not available, consists in making small heaps of vine cuttings; cheap coal tar is poured over them, and the whole covered with earth, so that, when set alight, the incomplete combustion produces a very dense smoke. Compounds of tar and pitch are also made, which can easily be lighted or put out.

A word may now be said of the theory more generally accepted to explain the protecting action of smoke.

When the temperature falls below freezing, the water contained in the parenchyma of the organs of the young shoot congeals, and as it increases in volume, it is forced out of the parenchyma on to the surface of the leaves, where it forms very minute crystals of ice. When the sun suddenly darts its rays on the frozen surface the crystals thaw rapidly, and the water disappears before the leaves have had time to re-absorb it, and death ensues. When, on the other hand, the plant is screened against the warming action of the sun, the thaw is slow and gradual, and the leaf re-absorbs the water as the minute icicles melt on its surface, the cells become turgid, and the plant escapes injury.

This may be proved experimentally by placing any bagging over a vine on some frosty night and laying a minimum registering thermometer on the ground. By removing the bagging towards eight o'clock, when the sun is well up in the sky, it will be seen that although the temperature has gone four or five degrees below freezing, and all surrounding vines are frost-bitten, the protected vine is not injured.

This explains the protecting action of the screen formed by the artificial cloud, which does not prevent the temperature from falling to any extent, although it partly has this effect if lighted before the drop of the temperature. But when the air is still and the firmament bright and cloudless, which is a necessary condition for the production of white frost, and the fires are lighted half-an-hour before sunrise, the smoke spreads horizontally and its thickness shelters the soil from the first sun rays, causing the thaw to take place slowly and gradually, enabling the plant to reabsorb its water of vegetation and escape uninjured.

Smoke not freely permeable to radiant heat should be preferred, as it is to that impermeability that artificial clouds owe their protecting action. Although heavy, thick, black smoke, resulting from the combustion of coal tar, pitch and such like, is not easily penetrated by light, on account of the coal particles in suspension, it does not offer such great opposition to the passage of heat as lighter smoke resulting from the burning of manure, which is charged with steam and the ammoniacal gases contained in the manure. Green weeds, grass, and dead leaves also furnish very good smoke, as they contain a large amount of water which can be increased by sprinkling water over the heaps after lighting. Water containing a little ammonia improves the smoke. Manure is generally found to give the best result. Unfortunately, it is too valuable a material to be used in this way.

One of the difficulties resides in ascertaining the temperature at about four o'clock every morning. A thermometer should be laid on the soil in the lowest part of the vineyard, and, with the help of an alarm clock, some one must rise every morning to ascertain the temperature. You may rise several mornings in succession only to find that the temperature has not fallen below freezing. Having risen early to no purpose, you will remain in bed some fine morning, trusting that things will be all right, and find that you are too late—the vines are frost-bitten.

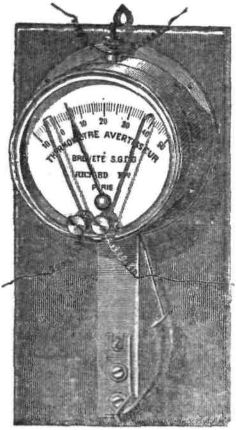


FIG. 1.—Jules Richard's Frost Registering Thermometer.

A number of instruments have been invented to prevent the occurrence of such accidents. Desage, of Heidelberg, devised a table based on the dew point of the air. The temperatures of a wet and dry bulb thermometer are taken after sunset, and by the reading of the table we know whether to expect a frost in the morning or not.

Another device consists in a special thermometer (Fig. 1) placed in the centre or lowest part of the vineyard, and connected with the bedroom of the manager by electric wires; an electric battery (Fig. 2) causes a bell to ring when the temperature falls below freezing. Any temperature may be determined beforehand by shifting an index. This thermometer costs the small sum of 18s., and may be obtained from Jules Richard, Paris.

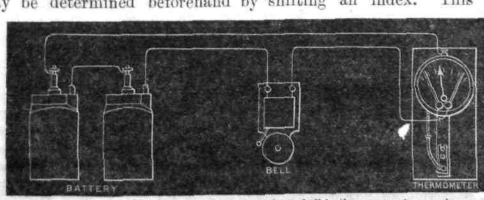


FIG. 2.—Jules Richard's Thermometer connected to a bell in the manager's room by an electric battery.

Treatment of Frost-bitten Vines.

When vines have been frost-bitten they should not be abandoned without care, as certain viticulturists do, arguing that as little as possible should be done to a vineyard which is not going to bear any

crop; but, on the contrary, the growth should be aided as far as practicable by pruning and ploughing. The crop resulting from these operations generally pays for this work.

If the shoots are only 1 or 2 inches long it is best to leave them alone. If, on the other hand, they are already 6 or more inches long and show fruit, the withered part should be cut off on the shoots showing grapes, and all other shoots cut back to the bud nearest the spur. The dormant bud, which ordinarily would have developed the following spring, will give rise to a shoot almost as strong as those grown normally. They even sometimes bear grapes if the soil is in good condition, and if the pruning was done early enough.

In connexion with this question, it is interesting to quote Mr. P. C. Rossi's experience in the Madera and Sonoma counties of California, as published in the *Pacific Rural Press.*

The questions propounded were the following:—"1. Did you remove the frost-bitten shoots? 2. If you did not, how did they behave? 3. In either case what was the result as regards the setting of fruit? 4. Are the berries dropping, and, if so, do you think it is from the effects of the frosts, and what makes you think so or otherwise?

"The answer, as made by P. C. Rossi, president of the Italian-Swiss Agricultural Colony, is as follows:—The vineyards at Madera were badly frost-bitten twice, so that the shoots that were not killed at the first frost were certainly killed at the second, which happened three weeks later than the first. Immediately after the first frost we had all the vines stripped entirely of all frosted shoots, and we repeated the same operation after the second frost, by so doing cleaning entirely the vines, so that the vineyard appeared without vegetation; and to our great satisfaction we are pleased to state that all the dormant buds came out with a good crop of grapes, bearing, therefore, two-thirds of the crop. The vineyards at Madera did not appear to be affected with coulure, and at present date everything appears satisfactory.

"The experience which we had at Asti, Sonoma county, fully corroborates the one that we had at Madera. Our vineyards in Sonoma county were only affected by the frost once, that being the last frost that came, the first time in fifteen years, only the vines on the lower land being affected, while those on the hillside were not touched at all. We had all the vines affected by frost entirely stripped of the damaged shoots, and we had the pleasure of seeing that, in a short time after, all the buds came out finely with their regular two bunches of grapes; therefore, we have lost only one-third of the crop. In order to make careful experiment we left a row of vines untouched, and the result proved that the vines that were not stripped did not do as well as the others, as the dormant buds in many cases did not come out, and those that came out were not healthy and strong, and had hardly any grapes. The damaged shoots that were not removed died gradually, and at the junction with the cane new shoots came out without any grapes at all. The result clearly proves that we will have fully two-thirds of the crop out of the frost-bitten vines which were stripped of the damaged canes, while we will not have hardly any first crop and only a second crop on the vines which were not attended to."

VINE-GRAFTING.

By G. Foëx, translated by Raymond Dubois and W. P. Wilkinson.

Object of Grafting.

The object of grafting is the propagation of a plant by fixing it on another plant called a graft bearer, which furnishes it, by means of its roots, with the nourishment necessary to its life. The graft-bearer is termed the *stock*, and the fragment to be propagated is called the *scion*.

Grafting, like other methods of multiplication by segmentation, insures the preservation of all the qualities belonging to the scion; the stock can only influence the scion in so far as vigour and development are concerned, but special properties, such as the constitution of the flowers, colour, shape, and taste of fruit for instance, cannot be modified. Sometimes the size and the saccharine strength of the grape are increased; this happens even if a variety is grafted on its own roots. All that has been alleged with regard to the sterility of scions grafted on unfertile stocks, the alteration in the taste of fruit of European varieties grafted on American species having *foxy* grapes, or of the non-affinity between stocks with white fruit and scions with black grapes is *quite erroneous*, and must be regarded as *simply dictated by ignorance*. The same thing applies to the stock which, when grafted with another variety, never modifies the nature of its roots or stem tissues.

Grafting can only take place between plants belonging to closely related botanical families; with regard to vines, the limit of affinity seems to remain within the genus. Inter-grafting of the different species of the genus *Ampelopsis*, as also of the genus *Cissus* and *Ampelocissus*, has always failed, and *a fortiori* also when the grafting of vines on plants belonging to other families (*mulberry, whortleberry, blackberry, clematis*) was tried. Even the *V. rotundifolia*, with its peculiar characteristics, does not knit with other species of the same genus.

The knitting which unites stock and scion is effected by the contact of the *generative layers*, the tissues of which unite and become modified for that purpose. The surrounding conditions necessary for the performance of this phenomenon are first, sufficient moisture to prevent the desiccation of the tissues of the graft; second, sufficient temperature to promote the rapid formation of new cells within the generative layers.

The first condition is so very important with vines that the graft can only be performed with success underground, the surrounding soil preserving the necessary amount of moisture which cannot exist in the surrounding air.

The Romans grafted vines, and this operation was formerly exclusively used in the South of France. It is possible with this

method of propagation to change the nature of a vineyard without wasting any time, and it was used in the Hérault to replace old cépages by *Aramon*, or cépages sensitive to *mildew* (*Carignan*, *Grenache*) by others resisting this disease better. Grafting also hastens the fructification of varieties naturally ripening their fruit late in the season. Cazalis-Allut recommended it for *Muscat of Frontignan*, which only gives a complete crop the fifteenth year.* It rapidly recuperates the production of vines weakened by age, and is, as we have already seen, the best method of hastening the florescence of young seedlings. It may be used for the rapid multiplication of rare and expensive vines. Finally, by grafting European varieties on American resistant stocks, it prevents the extermination of the former by *phylloxera*, and preserves their undoubted superiority. The reconstitution of vineyards by this means gives to this operation greater importance than ever.

Grafting Operations.

We will study the following points :—

- Age at which the stock can bear the graft.
- Selection of scions.
- Best time for grafting.
- Different methods used.
- Grafting machines and implements.
- Ligatures and waxing.
- Care to be given to grafts.
- Conditions of application of grafting.

Age at which Stock can bear Grafts.

It is possible to graft a vine at any age, from the time when it is a simple cutting till it is exhausted by many years pruning and production ; in the latter case it imparts new youth and new fertility by replacing old foundation wood with healthy young wood. But during this long period all ages are not equally favorable to the success of the operation ; the grafting of cuttings, for instance, gives a lower percentage of strikes than the grafting of rooted vines, which is easily explained when we remember that a cutting has not only to knit with the scion, but also to root. Notwithstanding this, the grafting of cuttings tends to be generalized, as it enables growers to obtain results quickly, and gives a sufficient strike in certain climates if proper care be taken.

As far as rootlings are concerned, it may be stated that the younger the plant the greater the proportion of knittings. This is explained by the freshness of the tissues in contact, which is favorable to the prompt formation of abundant cells necessary for the knitting to take place, and probably also by the system of grafting used in these cases, cleft graft or whip tongue graft, which may be considered as the best.

* *Memoires sur l'Agriculture, la Viticulture et l'Œnologie*, by Cazalis-Allut, Montpellier, 1848, p. 73.

The importance of grafting young stocks is more apparent with graft-bearers belonging to certain species, such as wild *Riparias*, with which the percentage of knittings diminishes as the plant grows older. However, the herbaceous grafts, which theoretically realize the best conditions, have the disadvantage of being more difficult to perform, but of giving rise to more vigorous vines. As, therefore, they have been so far very little used in France we will study more especially the grafting of lignified canes.

Selection of Scions.

(*a*) *Selection of Canes.*—As grafting preserves the characteristics of the mother plant, and in a certain measure those of the cane itself, it is important to select canes amongst the most fertile and healthier shoots, showing well defined characteristics of the variety to be propagated. Those having borne non-setting flowers and badly coloured grapes should be discarded. Further, they should be well lignified, bearing all their buds, of medium development, and containing as little pith as possible. These latter conditions, which are met with on the canes of old stumps, are important, in so far as their wood is not liable to dry before knitting takes place, or to split when the cleft is made; the strength of the joint, and, therefore, the knitting, are assured.

The canes of young plants are softer, dry easier, and offer less chance of success.

(*b*) *Best Time to Gather Canes.*—Experience has proved that to insure the success of this operation the vegetation of the scion must take place later than that of the stock. Knitting can then take place before the leaves have developed sufficiently to evaporate water, and, consequently, desiccate the scion. It is therefore important to gather the canes before the sap has started rising, and to preserve them until the moment of grafting.

(*c*) *Preservation of Scions.*—The conditions for good preservation of scions are similar to those indicated for cuttings; they should be prevented from growing to avoid the above-mentioned dangers. To realize these conditions we may, as is done in the South of France, place them in bundles of 50 in cellars where the temperature remains low, and cover them with almost dry sand (10 per cent. of water only), or again, place them vertically in trenches 3 to 4 feet in depth, sunk in a shed or exposed to the south near a wall, the cuttings being covered with sand first and earth on the top. We must take the same care as with cuttings when removing them from the stratifying beds.

(*d*) *Means of Ascertaining the Vitality of Scions.*—Accidents may happen which prevent the perfect preservation of canes. It is therefore important to be able to ascertain before the grafting operation if such canes are capable of knitting. The following processes may be used with this object:—A section is made through a cane, and if the green layer placed under the bark has become dry and black we may be sure that it has lost all its vitality. But this does not mean that the canes

which have remained green are capable of knitting. Under these circumstances, the best means of ascertaining their quality consists (as recommended by Louis Vialla) in placing a few canes taken here and there from the bundle in a bucket of water kept slightly warm for a few days, by exposure to the sun or placing over a range in the kitchen. If the buds swell and open, and if drops of water are seen on the top section of the canes, we may be certain that the wood is in good condition.

Best Time for Grafting.

After the graft is made it must knit as quickly as possible, therefore it should always be performed during the period of vegetation, that is to say, in spring. However, autumn grafts have often been recommended; these give more time to perform the operation, and enable vine-growers to employ fewer operators. These grafts give excellent results in certain years when growth lasts long enough to allow the knitting to take place before winter. They have also resulted in dismal failures in years of early frosts or abundant rains. We must not forget that grafts remaining a long time before knitting are exposed to various dangers. The tissues left bare dry away, and other deterioration capable of preventing the knitting takes place. Further, spring frosts may destroy the young buds or suddenly arrest the growth, causing grafts to die. It is therefore in spring, from the middle of March to the end of May (about September to November in Victoria) that circumstances are most favorable.

Dull weather with slight showers preventing the desiccation of the scion, but not checking its evolution through excessive humidity, should be preferred, when possible. Dry north winds or abundant and continuous rains are, on the contrary, unfavorable conditions.

Different Methods used.

Vines may be grafted by all systems used for other woody plants, but a few only give practical results. We shall rapidly survey the different methods recommended, only describing in detail those which have proved successful and are generally adopted.

In France grafts made on lignified wood are practically alone used; experience has proved that if they are made above ground they do not succeed on account of the rapid desiccation of the sections exposed to the air. Underground grafts have therefore been almost exclusively adopted.

It has also been proved that grafts by approach generally give more vigorous plants and more perfect knitting. We will therefore study the different methods of cleft grafting, the most used being: (*a*) *Ordinary cleft graft;* (*b*) *English cleft graft;* (*c*) *Whip-tongue graft;* (*d*) *Side cleft graft;* (*e*) *Cutting graft.*

(*a*) *Ordinary Cleft Graft.*—This is the oldest graft used, and was for a very long time the only one. The soil is dug away from the stump down to the level of the first large roots; the trunk is cut 1 or 1¼ inches above the surface of the soil (Fig. 1) so as to avoid as much as possible the liberation of the *V. vinifera* scion when grafted on American stocks. The section is cleaned and smoothed with the grafting knife. It is then split along its diameter with a special chisel, or knife, if the trunk is not too large. In the first case the chisel is placed a little sideways (Fig. 1*a*), and when the cleft is made the upper part is slightly widened by cutting away two tongues of wood on each side, the thickness of which depends on the size of the scion. A more regular and neater section is thus obtained, and the crushing resulting from the pressure of the sides of the cleft is thus avoided.

The scion usually carries three buds and an internode below the inferior bud. This internode is cut wedge-shaped, the two bevels of the wedge being closer together on the side opposite the eye. One of the

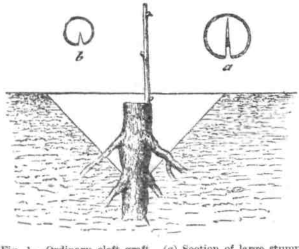


Fig. 1.—Ordinary cleft graft. (*a*) Section of large stump cut with a chisel. (*b*) Section of a small stump cut with a pruning bill.

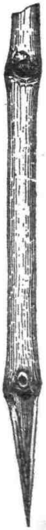


Fig. 2.—Scion used for ordinary cleft grafting.

bevels must be more slanting than the other, so as to avoid cutting into the pith on both sides (Fig. 2); by doing so a continuous piece of wood is left strengthening the wedge. This scion is inserted into the cleft, forcing the under-bark to correspond everywhere. This is the main condition of success. Many operators are contented to make the bark correspond outside, but as the bark of old stock is thicker than that of the young canes, it may happen that the generative layers be parallel without coinciding. To avoid this difficulty the scion should be placed slightly oblique, so as to allow the inner bark to correspond in one point at least. When the scion is in its proper position the chisel is taken out of the cleft. When the stock is very large it is better to insert two scions to sustain proportion between the aerial growth and that of the

stock (*Fig.* 3). The chance of success is thus doubled, and if both scions knit the weaker is removed the following winter.

This method of grafting is generally used for old stocks. For young vines of smaller diameter we may ligature so as to obtain sufficient pressure, or only make a cleft on one side with the grafting knife (Fig. 1 *b*).

(*b*) *English Cleft Graft.*—This method (Fig. 4) is very extensively applied for young rootlings, on account of its easy execution and the double chance of success it offers if properly performed.

Fig. 3.—Cleft graft with two scions.

Fig. 4.—English cleft graft.

The soil is removed from the young rootling as in the previous case; it is cut level or slightly above the surface, but low enough to allow the soil to be mounded round the joint, and is split with a chisel or knife. The scion is selected of an equal diameter, so as to obtain knitting on both sides. It is cut wedge shape, the two bevels being equal and inserted in the cleft, being careful to allow both sides to coincide outside, as in this case the bark of both stock and scion is practically of the same thickness. The results obtained with this method are satisfactory, and it is quite equal to the whip-tongue graft. However, the joint is not as strong the two first years, and it produces large pads of knitting tissue.

(*c*) *Whip-tongue Graft.*—It is only since the grafting of European vines on American species was started that the whip-tongue graft was invented. It may be considered as giving the best results when well performed, and when the stocks are young enough to allow the grafting of scions of an equal diameter.

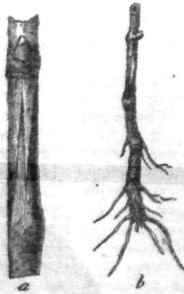


Fig. 5.—Whip-tongue graft with long bevels:—(*a*) on cutting; (*b*) on rootling.

The soil is removed as in the previous case, and the stock cut at a bevel, level with the soil (this is done with a special knife), and a vertical cleft made towards the centre of the section. Formerly this bevel was made very long (Fig. 5) so as to increase the surfaces of contact as much as possible, and obtain good knitting and a small pad, but experience has proved that long bevels form long tongues, which dry very easily, and therefore cannot knit. Further, the bevels are not rigid enough, and the

joint is weaker. Pulliat* advocates a bevel of 28 to 32 per cent., which corresponds to an angle of 16° to 19°, and a tongue about a quarter of an inch in length (Fig. 6). The scion is prepared in exactly the same way, being careful to make the section as close as possible to the bud; it is affixed to the stock, so that each tongue is inserted in each cleft. If the graft is properly performed all the sections should coincide, not leaving any part exposed to the air. It should be arranged in such a way as to keep quite rigid without the aid of a ligature. Whip-tongue grafts, which can only be made to coincide with the aid of a ligature, rarely give good knittings; in this case the ligature simply serves to prevent the displacement of the joint in case of knocks.

Fig. 6. — Whip-tongue graft with short bevels.

About one-fifth of an inch is the minimum diameter for a stock to be grafted, the operation being rendered too difficult if it is smaller. The maximum diameter is limited by that of the scion. However, it is possible to graft with this method a stock larger than the scion, but the beneficial effect of the double knitting is then lost; two to three eyes are left on the scion; this depends on the length of the internodes. However, in the case of grafted cuttings, one bud only is left, so as to keep a certain proportion between the outside growth and the development of the roots at the start, and avoid the desiccation which would result from the evaporation caused by too large a number of leaves.

The whip-tongue graft, which generally enables growers to replace European vineyards by American vines within a year, gives the best results with regard to the proportion of knittings and the constitution of the plants. This seems to be due to the large area of the surfaces of contact, which allows better knitting, facilitates the exchange of food material between stock and scion, and forms a long and flat cicatrice, which does not injure the ultimate development of the plant. The whip-tongue graft, on account of these advantages, will always be the most used in reconstitution of vineyards, as soon as the number of operators capable of performing it increases.

The *Champin Graft* (Fig. 7) is only a modification of the whip-tongue; it is more difficult to perform; it gives less satisfactory knittings, for a part of the section is exposed to the air; and, moreover, it facilitates the growth of roots on the scion.

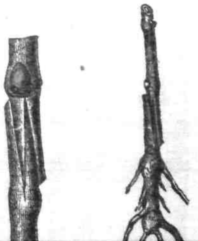


Fig. 7.—Champin graft:—(*a*) on cutting (*b*) on rootling.

* V. Pulliat, *Manuel du greffeur de vignes.* Bibliothèque du *Progrès Agricole*, rue d'Albisson, Montpellier, 1885, pages 19 and 20.

The *Saddle and Camuset* (Fig. 8) grafts are the reverse of the cleft graft. These grafts are difficult of execution, and do not form such good unions as the cleft graft.

(*d*) *Side Cleft Graft.*— Several methods of side clefts have been recommended ; they do not differ much from one another. The most used are those due to Gaillard, Brignais, Dauty, of Montpellier, and Constant Ballan, of Omey, also known under the name of Cadillac graft.

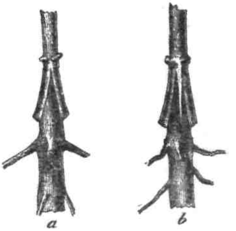


Fig. 8.—(*a*) Saddle graft ; (*b*) Camuset graft.

These methods consist in placing the scion in a cleft made on the side of the trunk, the head of the stump being retained. According to their promoters, they possess the following advantages :— By preserving the head of the stock a better vegetation is secured while the knitting takes place; in case a graft misses it renders further grafting possible, this being impossible with beheaded stocks, and it preserves the crop of the stock until the scion is capable of yielding fruit.

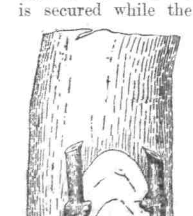


Fig. 9.—Gaillard graft.

Gaillard's graft is performed in the following manner :—Level or slightly above the soil a horizontal and shallow cut is made with a saw (Fig. 9 *B*), a chip of wood is detached from the top by means of a chisel held slantingly. On the horizontal section thus exposed a cleft is made parallel to the axis of the trunk, in which two scions are inserted (Fig. 9 *e, f*). The joint is then strongly bound.

Dauty's graft is similar, but in this case the graft is made with a bent secateur S (Fig. 10), which makes a kind of notch, and the cleft at the same time.

Cadillac's graft only differs from the two above-mentioned in its cleft, which is made slanting instead of vertical, without previously making a notch. The stock *c* (Fig. 11) is cut on the side at *b* about an inch above the level of the soil ; the scion *a*, cut wedge shape, is inserted in this cleft with the usual precautions ; the joint is bound with raffia so as to prevent the scion from being displaced. One bud only is left on the scion so as to prevent the joint from splitting under the weight of long shoots. Finally, the soil is mounded round the joint to prevent it from drying.

Grafting tools have been invented to render this operation easier. The first is a kind of forceps with flat jaws (Fig. 12). A long opening,

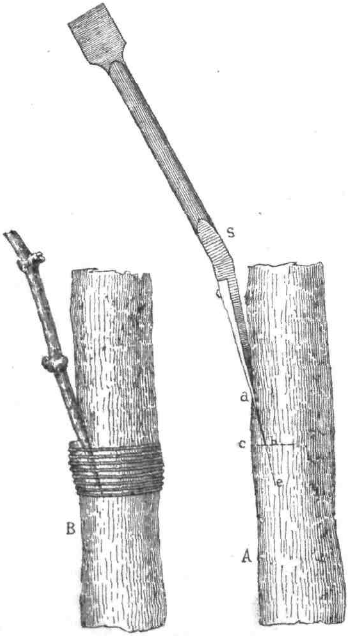


Fig. 10.—Dauty graft.

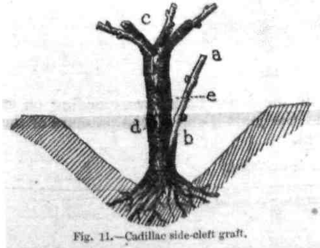


Fig. 11.—Cadillac side-cleft graft.

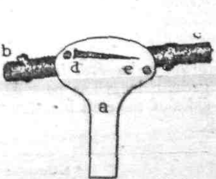


Fig. 12.—Forceps used for side-cleft grafting.

d e. is made in one of the jaws, to allow the passage of a triangular blade of a special knife (Fig. 13). The cane *b c* is kept in position by

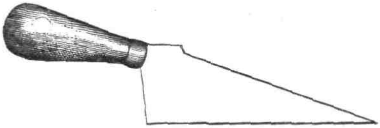


Fig. 13.—Knife used for side-cleft grafting.

the pressure of the jaws and two small pins, *d* and *e*; the cleft is made very neatly by sliding the blade of the knife into the opening. Other methods of grafting or budding, such as the graft by approach, the end to end graft, have been recommended, but very soon discarded on account of the small percentage of strikes.*

(*e*) *Cutting Graft.*—This system is only used in very special cases when the graft has to be liberated after the knitting. The stump in this case is only used to temporarily feed the scion which grows independently when it has thrown its own roots. It is sometimes useful for the propagation of American vines. However, to obtain good results this graft should be performed in very mellow, rich soil, capable of feeding the new plant in the place where the old stump grew previously.

The soil is removed, and the stock cut, as in the case of an ordinary cleft graft; a slightly bent cutting, with a piece of two-year-old wood at its base, is selected; two slices of bark are taken away on each side, so that it resembles the blade of a knife (Fig. 14). This

Fig. 14.—Cutting graft.

blade is inserted into the cleft, the inner bark corresponding on as great a length as possible, and the joint bound if the pressure of the sides of the cleft is not sufficient.

(*To be continued.*)

* A. Champin: *Traité théorique et pratique du greffage.*

HORTICULTURE.

THE NON-SETTING OF FRUIT.

By G. H. Robinson.

A common cause of complaint among fruit-growers is the non-setting of fruit. Every season this trouble is felt to a greater or less extent in one district or another, and information bearing on the subject is being continually sought. Hence it is well to inquire into the various causes which may induce non-setting, and ascertain what methods, if any, are known whereby the losses may be avoided either wholly or in part.

The Influence of Insects on the Setting.

Taking the pear as an example, before the fruit can be formed the yellow powder, called pollen, which is produced by the stamens of the flower, must be brought into contact with the stigma, that is, the upper portion of the pistil, or female organ. In this position the pollen grain germinates and pushes forth a fine tube, which grows down into the soft tissue of the pistil till it reaches the ovules, fertilizing them, and causing their development into seeds, and it is the stimulus thus imparted that results in the formation of the fruit. Darwin has said that "Nature abhors self-fertilization," and here at least the statement is undeniably true, for it is found that the pistils of the flower mature about three days before the pollen. As a consequence, the pollen which is necessary for fertilization must be transferred to the stigma by some outside agent. The sugary substance, called nectar, which is secreted in the blossom, forms a strong attraction to many insects, and they, in their efforts to obtain this dainty food, inadvertently carry the pollen from flower to flower. Abundance of insect life at the blossoming time is therefore necessary to secure good setting. Where orchards are planted in large contiguous blocks there is a constant danger of short crops, owing to the number of insects being probably inadequate to perform the work of fertilization. This, however, may be easily remedied, as bees, which are most useful in this way, may be pressed into service, though the writer is inclined, from his own observations in Northern Victoria, to attach much greater importance to those insects which frequent the blossoms about dusk than is usually accorded to them by horticultural writers.

The Weather in Relation to Non-setting.

Fertilization, as we have seen, is dependent upon the presence of insects, hence it follows that whatever tends to check their visits will injuriously affect the setting of the fruit. Wet weather has long been regarded as exercising a detrimental effect at this period, and many experiments have been made to test the truth of this. The general conclusion come to is, that whereas a few showery days may be regarded

as of no importance, the setting is seriously interfered with by continued rainy weather, and chiefly because it prevents the visits of insects. Raspberries, however, seem little subject to injury from rain, for F. W. Card, of the Cornell University, U.S.A., reports good crops where the plants were sprayed with water during the whole of the blossoming period, about fifteen days.

Excessive moisture during the period of blooming greatly favours the growth of many fungi; the Twig Blight of the peach and the Black Spot of the apple under such conditions may enormously reduce the setting in those varieties subject to their attacks. These and other parasites, by destroying the foliage and weakening the tree, may also retard the formation of fruit buds for the following crop.

In this climate non-setting is rarely, if ever, due to winter-killing of the flower buds. Heavy frosts when trees are in bloom have a bad effect; one or two degrees below freezing point is the lowest temperature that can be withstood in warm climates, though in colder regions it has been found by Professor L. H. Bailey that peaches suffered no injury from 5 degrees of frost when in full bloom. The effect of frost, no doubt, largely depends upon the way in which thawing occurs; if rapid, the consequences will be much more serious than if proceeding slowly.

Self-sterility of Certain Varieties.

So far consideration has been given only to causes affecting all fruits to a greater or less extent. But there are some varieties which fail to produce good crops under certain conditions, because they are self-sterile. By this is meant that the pollen from one tree is incapable of fertilizing the female portion of another blossom of the same variety, though quite efficient on a distinct kind. In those which are self-fertile, on the other hand, the pollen is able to fertilize other flowers of the same variety. When complete self-sterility exists, fertilization can only occur from cross-pollination; that is, the pollen must be derived from a distinct horticultural variety. But it is found that self-fertilization takes place in some degree in nearly all varieties, though the resulting fruits are rarely so large and the seeds generally fewer and smaller than in cross-pollinated fruits. These two divisions also tend to merge into one another, so that a variety under certain circumstances self-sterile may elsewhere prove sufficiently self-fertile as to yield fair crops even when secured against cross-pollination. In general, it may be said that self-sterility either shows itself or becomes accentuated under conditions not the most suitable to the variety in question. It is to the researches of Waite and Fairchild in America that our present knowledge of the problems in fertilization of the apple and pear is largely due. Others have followed similar lines of work with various fruits, but there is less certainty about the results obtained, and from the commercial aspect these are to local growers less valuable.

The Williams' Bon Chrétien pear has been extensively planted in Victoria within the last decade, and especially in our northern districts. In many orchards no other variety has been grown, a result due

primarily to the belief that this was the only profitable pear suited to the prevailing conditions. The unsatisfactory yields so often obtained are doubtless due to partial self-sterility, found to be a marked characteristic of this variety in the investigations previously referred to. In the following list the behaviour of some of our best sorts to their own pollen is given:—

Self-sterile.	Self-fertile.
Beurré d'Anjou.	Beurré Bosc.
Beurré Clairgeau.	Duchesse d'Angoulême.
Easter Beurré.	Flemish Beauty.
Gansel's Bergamot.	Kieffer.
Louise Bonne de Jersey.	Le Conte.
Winter Nelis.	Seckel.
Williams' Bon Chrêtien.	

With regard to the Kieffer, Duchesse d'Angoulême, and Seckel, it should be noted that in cold climates and in wet springs they are strongly inclined to self-sterility, though under more genial conditions abundant crops are borne, even when planted alone in large blocks. Cross-pollination usually takes place in average orchards to such an extent as to justify the conclusion that "the normal typical fruits and in most cases the largest and finest specimens from both the so-called self-sterile and self-fertile varieties are crosses." Hence cross-pollination may be regarded as a decided advantage with all kinds of pears.

Self-sterility in Apples.

Much the same conditions have been found to exist in apples as in pears, though as a rule the differences in the behaviour of the varieties as regards fertilization are not so well marked. In apples, for some reason a larger selection is in general found in our orchards, and as they blossom later than the pears, and their flowers are particularly attractive to insects, cross-pollination occurs to a great extent without our knowledge. The inferiority of self-pollinated fruits is even more marked than with pears. In many characteristically self-fertile varieties it is found that fully three-fourths of the crop is cross-pollinated, and the self-fertilized fruits are, as a rule, much smaller, less highly coloured, and deficient in seeds. Among those most liable to non-setting through self-sterility may be classed the Rhode Island Greening, Esopus Spitzenberg, Gravenstein and Northern Spy.

Other Influences.

It is commonly said that this or that variety only bears a good crop every second year, though some growers maintain that this is due to faulty pruning. Strictly speaking, the trouble here does not arise from non-setting, but rather from the sparse production of flower-buds. Over bearing in one season certainly tends to diminish the vigour of the tree, which in turn prevents the formation of fruit spurs, and also leads to self-sterility. The absence of flower buds is specially noticeable in young peaches and apricots that have the previous year borne crops beyond their capacity to properly mature. Whether this over-cropping of young trees tends to intermittent bearing in after years is still an open

question, and one worthy of more attention. The common practice of irrigating just after a heavy crop has been removed has its origin mainly in the belief that the vigour of the tree is thereby increased, and the formation of flower buds assisted, and the chances of a good setting the following year improved.

Practical Conclusions.

Though we may not hope to control the influence exerted by the weather during the blossoming period, we are still able to prevent non-setting in so far as it is due to the other causes mentioned. It will be readily recognised that the planting of large blocks of single varieties of apples or pears is not a policy to be generally recommended. Though the tendency among those newly entering into the business of fruit-growing is mostly in the direction of planting too many sorts, the opposite policy of restricting the number, is in some instances being carried too far for safety. Where large blocks of one variety exist and are found to do well in all respects save fruiting, a good plan is to graft every third or fourth row to some other kind, as the trouble probably arises from self-sterility. To secure cross-pollination under these circumstances, or in closely-planted centres, the keeping of a few hives of bees will prove of great value. Lastly, no measures should be neglected which are likely to produce an even growth from year to year if satisfactory crops are to be obtained.

VICTORIAN FRUIT IN LONDON.

By J. M. Sinclair.

The "Ortona" Shipment.

The market for Victorian and Tasmanian fruit this week in London was no improvement on the previous one. The cold, unseasonable weather continued, and, with full supplies offered, no improvement in prices can be reported. For Victorian apples, New York Pippins realized from 11s. to 14s., Munro's Favorite 10s. to 13s., Jonathan 10s. to 11s., Rymer, London Pippin, Stone Pippin, and other varieties sold at from 8s. to 9s. 6d.

Some 500 cases of small parcels of Victorian apples have gone direct to a firm in Nottingham. They inform me that the prices realized for Adam's Pearmain and Jonathan have been 10s. to 14s. A few lots of pears and grapes sold from 11s. to 14s.

In Liverpool this week 11,500 cases of Tasmanian apples, ex *Orestes*, were sold at prices equal to those obtained in Covent Garden; New Yorks 10s. to 13s. 3d., for a large consignment, Adam's Pearmain 9s. 6d. to 10s. 9d., French Crabs 9s. to 10s. 6d., Scarlet Pearmains 9s. to 10s. 6d., other varieties 8s. 6d. to 10s.

The "Britannia" Shipment.

The consignment of 2,169 cases of apples and 57 cases of pears from Melbourne was landed here on 19th of May, and upon inspection was found to be in fairly good condition. In some cases of Rymers the lid pressed too tightly upon the apples, and the top row were all bruised. Many of the Jonathans, Morgan's Seedlings, Ben Davis, and Five Crowns were sound, while a few others were specked.

The pears had some cases damaged, and in one instance the lid had pressed upon the top row, and, besides bruising that row, injured many below.

According to the log, the temperature at which the fruit was carried was 43 degrees.

The fruit was sold at Covent Garden and other London markets. The unseasonable weather previously referred to has continued, and is reported to exercise a certain influence on prices. These do not show any marked improvement on last week's rates. Victorian apples sold as follows :—

Cleopatra	10s. to 14s.
Munro's Favorite	14s. to 14s. 6d.
Newtown Pippin	14s. 6d. to 15s. 6d.
Perfection	14s.
Spitzenberg	10s. 6d. to 12s.
Dunn's Seedling	11s.
Jonathan	10s., 11s.
Rome Beauty	8s. 6d. to 11s.
Rymer	8s. 6d. to 11s.
French Crab	10s.
Sturmer	9s. to 11s.
Ben Davis	8s. 6d. to 9s. 9d.

Tasmanian realized almost similar prices. A small lot of Victorian pears, irregular in condition, sold at 9s. In others, half the fruit in the cases was bad. Some of the Victorian apples were not in perfectly sound condition. The Tasmanian were in good order, which would indicate that some of the Victorian were rather over-ripe when shipped.

The "Oroya" Exhibition Consignment.

The 100 cases of Victorian apples forwarded per *Oroya* were exhibited this week in the Floral Hall, Covent Garden. Having to be obtained so late in the season no doubt accounted for the fact that the consignment was not exceptional in regard to quality, nor, for show purposes, representative of the finest class of apples grown in the State. Their quality was no better than the average class of fruit exported during the season, and not good enough to attract any special attention on the part of those interested in the trade. This was the opinion of all in the fruit trade inspecting them, who were disappointed in the exhibit. Notice was sent to all the London daily papers and to all the trade and horticultural journals, many of these sending representatives to give a report on them. The only explanation which could be given for the very ordinary quality of the fruit to these, was that the lateness of the season prevented a good selection of the best varieties being forwarded. If it had been a really good exhibit, such as was forwarded five years ago, Victorian fruit would have obtained a wide advertisement and high prices realized, such as are always obtainable for show fruit of good quality. The Hoover variety, being ripe, were badly bruised and damaged in packing, many having to be taken out of the cases. The Rome Beauty realized best price, viz., 15s. per case. The cold, wintry weather experienced, and the fact that large quantities of French cherries are now on the market, materially affected prices for Tasmanian apples this week, and with them those for the small Victorian lot.

The following prices were realized for 99 cases sold, one case being handed over to Mr. McCulloch :—

Rome Beauty	15s.
Stone Pippin	11s.
Rymer	9s.
Hoover	8s. 6d.
Yates	11s. 6d.
Scarlet Nonpareil	10s.
French Crab	8s. 9d.

VICTORIAN FRUIT ON THE CONTINENT.

By J. M. Sinclair.

Some consignments of Australian and Tasmanian apples have been taken direct by the North German Lloyd steamers to Hamburg this season, and from time to time parcels of from one to four or five hundred cases have been sent there from Covent Garden.

I have been making inquiry into this trade, and find that it is capable of further development. From Hamburg the finest dessert varieties are sent to Brussels, Berlin, Vienna, and St. Petersburg, where they are appreciated, and realize good prices for use by the very wealthy classes. Only choice varieties such as Cleopatra, Munro's Favourite, Jonathan, Esopus Spitzenberg—and these of the best quality—are in demand. In forwarding from Covent Garden, some of the salesmen repack and sort the fruit before sending a consignment to Hamburg.

At present large quantities of Australian apples could not find a market at a high price, but with a wider distribution in many of the continental cities a remunerative figure could be realized for considerable consignments. Next year there should be an increased demand, and in view of this I am obtaining the names of the principal importing firms in Hamburg, and sending to them the names of the principal Victorian exporters of fruit, together with information concerning the trade. With direct steamers between Melbourne and Hamburg, a trade in dried and canned fruits, canned meats, &c., might also be developed. I expect to be able to furnish further information in reference to trade with Hamburg shortly.

The British Vice-Consul at Bremen states that a company is being formed there in connexion with the fresh fruit trade which proposes to interest capital in the establishment of a refrigerated steam-ship service with Australia.

The Vice-Consul at Brussels, in furnishing the names of the principal fruit importers there, states that there is no reason why a trade in Victorian fruit should not be done with that centre. I shall endeavour to visit Bremen, Antwerp, and Hamburg in July or August, when I will be able to give the importers in those cities every information, and will try to arrange for opening up a trade n xt season.

THE ORCHARD.

By James Lang.

Cultivation.

The month of September is always a busy one for the orchardist. The work of pruning and planting having been completed, cultivation now demands attention. Ploughing should be proceeded with as rapidly as possible, and especially in the drier districts, since if it be too long delayed the ground becomes hard and dry, and difficult, if not impossible, to work. It is always a good plan to finish the ploughing early, as it is then an easy matter to keep the orchard in a fine state of tilth during the summer.

Manuring.

Where it is intended to apply manure it is well to do so before ploughing. The writer has used for some years, with great satisfaction, a mixture of 84 lbs. of Concentrated Muriate of Potash (50 to 60 per cent. Potash), 112 lbs. Thomas' or Florida Phosphate (15 to 18 per cent. Phosphoric Acid), and 84 lbs. of Nitrate of Soda (16 per cent. Nitrogen), which it will be seen is a complete manure. The quantity given above is sufficient for 1 acre of medium-sized trees. Where the trees are larger and closely planted, double this amount could be used with advantage. In place of Nitrate of Soda, it may be found advisable to sow a crop of peas in the autumn, which should be rolled down in the Spring, as they are then easily ploughed under. By this means a supply of nitrogen as well as a considerable amount of humus is added to the soil, greatly improving its mechanical condition.

The Apple and Pear.

It will be necessary to closely examine all apple and pear trees in search of the grubs of the Codlin Moth; broken ends of branches should be cut off neatly, all loose bark scraped off, holes and hiding places searched, and the grubs destroyed. In old orchards especially this means a lot of work, but it must be remembered that destroying the grubs now will materially reduce the number for next season. As the Department has already given notice of its intention to enforce the provisions of the Vegetation Diseases Act, it behoves growers to use every precaution to reduce the pest in order to avoid serious losses.

Where the Black Spot or Scab is prevalent, towards the end of the month spraying with Bordeaux Mixture must be done. Full particulars of method of manufacture, as well as useful hints likely to simplify the work, more especially for the inexperienced, have already been given in the June and July numbers of this *Journal.*

Apricots and Peaches.

The Shot Hole of the Apricot and Peach may be controlled by spraying with Bordeaux just before the bursting of the blossom buds.

The Aphis on the Peach will soon cause trouble. As this pest is found on the roots of the trees during winter, a good plan is to bare

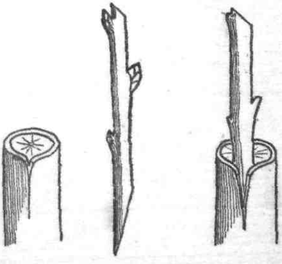
the roots and apply a little freshly-slaked lime, or a small quantity of a Potash manure. The Aphis may be destroyed by using 1 lb. of Concentrated Muriate or Sulphate of Potash in 2 gallons of water—a mixture which is also beneficial as a manure. Kerosene emulsion is one of the best insecticides; and the old remedy, Soft Soap and Tobacco, is also of great value. Frequent spraying will be found necessary to keep the pest under control.

Orchardists who are up to date make a practice of spraying the whole of their trees in the early spring with Kerosene emulsion or Resin Wash. Both of these are very effective against the Red Spider and Mussel Scale. The former in the northern districts does considerable injury, particularly to apples, pears, and plums when in bloom, and often causes the flowers to drop without setting any fruit. In using kerosene as a spray, it will be found of great advantage to have a kerosene attachment fitted to the spray pump.

The method of making Resin Wash will be found in the General Notes.

Grafting Old Trees.

Any old trees that have become unfruitful, or any unsuitable varieties, may be headed down and re-grafted; and, providing the stock is in a healthy condition, the scions grow strongly and soon make a tree again. A simple method of working large stocks is by what is called *bark grafting*. The branch is cut straight across, an incision made down the side, the bark slightly lifted, and a scion, cut on the bevel at the lower end, is inserted between the bark and the wood. This is the simplest and easiest method of reworking large stocks, and if the graft is properly tied and waxed over in the usual manner, so as to exclude air, very few failures are likely to occur.



BARK GRAFTING.
Stock with incision, Scion ready cut, and Scion inserted.

A good grafting wax is made by melting together equal parts of tallow, resin, and beeswax. This may be applied when melted to the graft after the scion has been tied in, or paper coated with it may be cut into inch strips and used for binding.

THE VEGETABLE GARDEN.

By Thos. W. Pockett.

More kinds of vegetable seeds have to be put in this month than at any other season of the year, and, as a consequence, the sowings should be done sparingly, otherwise the quick growth and great variety of the plants will cause the garden to become overstocked, a condition which must not be allowed to occur, for vegetables coming to maturity in the warm weather cannot be kept for any length of time.

The Preparation of the Soil.

Before dealing with varieties, however, it may be as well to point out that success in vegetable growing may be greatly assisted by proper attention to the preparation and cultivation of the land. Though of prime importance under all conditions, it is where the water supply is limited during the warm weather that neglect in this direction will prove most disastrous.

Periodical trenching, say once every three years, will be found to amply repay the labour, as it greatly increases the moisture-retaining powers of the soil during dry periods, besides exercising a sweetening influence in cold and wet seasons. Thorough working to a depth of about 2 feet will be found most generally satisfactory; land worked for only 1 foot will not hold moisture nearly so well in the summer.

Requirements of Different Vegetables.

Where plants like the marrow, cucumber, cabbage, cauliflower, and tomato are to be planted, it will be found good policy to apply a liberal dressing of farmyard manure about three weeks prior to setting out. The manure should be dug lightly in, and the land allowed to stand till just before planting, when a much deeper cultivation ought to be given.

Some roots, as for instance, beet, carrots, and parsnips, should follow a crop that has been heavily manured; but turnips, on the other hand, do best on soil that is rather free, but not rich, and preferably shallow.

Leeks and celery must be grown in very deep, rich soil, and the same applies to French beans, this being especially necessary for the latter as the season advances.

Seasonable Planting.

Tomatoes that have been hardened off may be set out on the sunny side of fences or other suitable spots, and sheltered from frosts by placing small branches around them. In the warmer parts of the State, and near Melbourne, no time need be lost in commencing this work; but in the colder districts it will be found desirable to wait till the end of the month. The last batches of cauliflower may be put in, and summer cabbages, such as St. John's Day, should now be planted,

and small lots of seed sown. French beans for the early crop may be sown immediately, and again towards the end of the month, to secure a succession. Early peas, if put in now, will be ready about the middle of November, and successive sowings of mid-season sorts should also be made, to come in a little later. If attention has not already been given to parsley, it should be sown without delay; while small quantities of turnip, carrot, parsnip, beet, lettuce, leek, onion, salsify, and scorzonera may also be put in. It is rather late for asparagus, but in good soil it will prove a success if sown early in the month. Seeds of turk's cap, vegetable marrow, and other gourds for the early crop may be put in, and in warm districts, or where sufficient attention can be given, the same should be done with cucumbers and melons.

Capsicum and egg-fruit plants succeed best if treated in the same way as tomatoes—that is, raised in a hotbed about July, and hardened off for planting out at the end of this month. Failing this, the seed may be sown in a warm situation, and the plants set out in their permanent quarters about the end of next month. It is also usual to make the first sowing of celery during September.

THE FLOWER GARDEN AND SHRUBBERY.

By Thos. W. Pockett.

Designing the Garden.

Success in the flower garden is dependent as much upon the arrangement of the plants and flowers as upon their subsequent management. Overcrowding and a liberal supply of water in the summer, followed by our mild winters, are the chief causes of the many unsightly and overgrown gardens that we see. In the first place we invariably mark out the positions for the most permanent plants, and then fill in with others of a temporary character, but these latter, through various causes, are often allowed to monopolize so much of the space that the original design is lost. Exactly the same errors occur, as a rule, in mixed borders, too many flowers and shrubs are grown together, they become favorites, we are in sympathy with them, and they are allowed to remain till crowded out.

Our climate, then, being so favorable for quick growth, the greatest care in laying out the shrubbery is necessary as regards the spacing of the permanent plants. These should be so arranged that a large proportion can exhibit their natural characters while the temporary specimens should be mainly composed of kinds that can be reduced in size without becoming unsightly, and, if necessary, eventually removed altogether.

As flowers require much more attention and a more liberal supply of water than hardy shrubs, a great amount of time and trouble will be saved if they are grown by themselves, or in close proximity to other plants requiring similar treatment. Mixed borders or beds would then be a success.

Work for the Month.

Most of the seeds and plants to be put in this month require good soil and a plentiful supply of water, if the best results are to be obtained. Where practicable they should be kept away from the roots of the more robust shrubs and trees.

In annuals there are a few favorites that should never be overlooked, and amongst these, Stocks, Zinnias, Asters, Portulacas, Marigolds, Amaranthus, and other half-hardy annuals may be sown. The Phlox Drummondi, if included, will flower successfully from November till February. Useful flowers for cutting may embrace Calliopsis, annual Chrysanthemum, Gaillardia, and Cornflower, all of which may still be sown.

The Cannas, which are so effective in clumps or beds, should now be planted, preferably in a deep, well-manured soil, and if sheltered from strong winds their beauty is greatly enhanced. Chrysanthemums, on the other hand, must be placed in fairly open situations, otherwise they are liable to suffer severely from insects and oidium.

In growing roses for large blooms, attention must be paid to thinning, so that there will be about four inches of space between the shoots, and the beds should be mulched with a couple of inches of fresh horse manure.

Ornamental beds and borders should now be prepared, and when well designed and properly planted, are amongst the most attractive features of the garden.

Lawns.

A dressing of superphosphate in moist weather will be found to exercise a most beneficial effect on buffalo or other summer grass lawns that show signs of impoverishment. In laying down new lawns, which may now be done, the best plan is to put pieces of buffalo grass in rows about 15 inches apart, leaving about 6 inches between the cuttings. If turf can be obtained of the Kentucky blue grass (*Poa pratensis*), a small piece dibbled in every foot or eighteen inches will be found to make, in conjunction with the buffalo, a good lawn for all seasons. The planting in rows will permit the hoeing of the ground until the grass starts to close in.

GRADING AND BULKING TOBACCO.

By Temple A. J. Smith.

Grading.

The winter months are those in which the grading of the tobacco crop takes place. As soon as the leaf and stalk are thoroughly dried out, and the change of weather has allowed the leaf to absorb sufficient moisture to permit its being handled without breaking, the tobacco is ready for stripping and grading.

It is wise at this time to bulk down a quantity of tobacco, *i.e.*, to place upon a platform well off the ground a heap from 4 feet to 6 feet wide and 4 feet high, taking care to stack it with the butts always to the outside. This will keep the tobacco soft for handling, even though a spell of dry weather should intervene. In some parts of America as many as twelve grades, or classes, of the leaf are made, but at present in Victoria we may be satisfied with three. The grader sits on a low stool, with the unstripped bulk on his left side. Taking a stalk, which he holds close to the butt, he strips off the lower leaves, the first two or three of which are usually of inferior quality. These he places on one side. The middle leaves are then taken, and the best put by themselves, and the top and all inferior leaves, such as grub-eaten or bad-coloured and sun-spotted leaves are made into a third heap. The best, or first grade, is composed of the finest-coloured leaves, with good texture and free from holes or blemishes, and as nearly as possible of even lengths. The second grade is formed of the smaller and slightly inferior leaves, and the third comprises the poorest quality. All these grades are tied into neat small bundles, called "hands," containing about fourteen leaves, the tie being a leaf of the same colour and texture as the quality of the hand. The butts of the leaves should be kept even, and the tie should begin as near the top as possible, and should not be more than an inch in depth. When tying, wind the leaf tightly round the butts, and finish off by tucking the end in between the leaves of the hand. Many growers make the mistake of tying too large hands, and bringing the tie too low down. This has the effect of making it look short and clumsy, and prevents it drying well, when again hung in the shed, as it must be after handing is finished. If very wet weather obtains, small fires should be kept going to drive out any excess of moisture.

Bulking for Sweat or Fermentation.

In the early spring, when you find the tobacco coming into condition for bulking, that is, when moist enough to handle without breaking, the hands are bulked in a large heap on a platform well off the ground, with the butts of the hands outwards. Great care must be taken to have the leaf in proper condition for bulking. Too much moisture will cause mildew, and too little will not allow of a proper sweat. The usual tests applied are to squeeze the tips of the hands together, and

if they open again of their own volition, and the midrib in the leaf will break when doubled two-thirds of the way down, it is safe to put tobacco down. Tobacco should always be put down as it is coming into condition, and not as it dries out, as it will continue to dry out in the bulk, and a good sweat will not result. It should be left in the heap for six to eight weeks, and even longer if warm weather has not come in. The bulk should be well covered with tarpaulins or cloths, which prevent the escape of the gases which assist the sweat. The heap should be carefully watched, and if the temperature reaches 80 degrees should be turned over, and, though not likely to heat again, it is wiser to keep an eye to it, especially as the weather becomes warmer. When opened up after a proper sweat, the tobacco will have a sweet aroma, and will have improved wonderfully in colour, quality, and appearance.

ECONOMIC ENTOMOLOGY AND ORNITHOLOGY.

THE FLAME-BREASTED ROBIN.

(*Petrœca phœnicea, Gould.*)

By C. French.

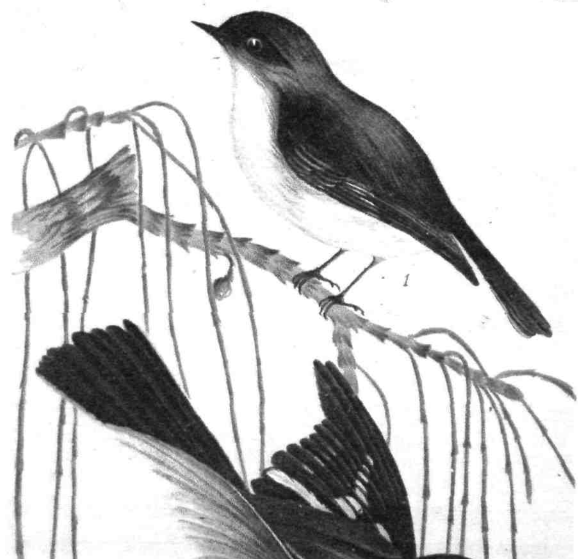
This beautiful little robin is one of our most valuable insectivorous birds, and was at one time fairly common in the parks and gardens around Melbourne. Of late, however, it is very seldom seen, the increase of population being largely responsible for this. The extreme tameness of these birds also renders them an easy prey for those who are always ready to kill any living thing, a class, unfortunately, all too common in our midst. As instancing how little fear of man they possess, I might mention that quite recently, while a cricket match was being played in one of the northern suburbs, a robin alighted on the hat of one of the players who was standing still, and remained there for several seconds until the fieldsman commenced to move.

According to Gould, the male has the crown of the head and all the upper surface sooty grey, except a small white spot across the forehead, a patch of the same colour on the shoulders and the anterior edges of tertials; primaries and tail feathers greyish black, except the outer feathers of the latter, which are nearly all white; upper part of throat sooty grey, the rest of the under surface rich scarlet, under tail-coverts white; irides, bill, and feet black.

The female is a uniform brown above, wings dark brown, tertials and wing-coverts edged with reddish grey, tail brown, the outer tail feathers on each side almost wholly white, all the under surface reddish grey; irides, bill, and feet black.

The flame-breasted robin is very active on the wing, and may be seen darting at and catching moths and other insects. It is also particularly fond of aphis of various kinds, and may be observed hopping about rose bushes, abutilons, bouvardias, &c., devouring great numbers of these destructive pests. Earthworms, grubs of beetles (*Coleoptera*), and moths and butterflies (*Lepidoptera*), constitute their principal food. These robins are firm friends of the farmer and orchardist, and when the ground is being ploughed they may be seen on the fences watching for any grubs, frequently darting down to pick these up, and then returning again to the fence, a work often going on for hours together.

The nest is usually placed in the fork of an old dead or burnt tree, or on the sides of steep banks, and is composed of strips and small pieces of bark matted together, and generally lined with hair, fine rootlets, fur, and occasionally feathers. The clutch of eggs is usually three, but Mr. A. J. Campbell states there are occasionally four. The breeding season is August, September, October, and November. These birds are found also in New South Wales, Southern Queensland, South Australia, Tasmania, King Island and other islands in Bass Straits.



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FLAME-BREASTED ROBIN.

Petræca phoenicea.

The male flame-breasted robin cannot easily be mistaken for the male scarlet-breasted robin, as the throat of the former bird is red, while that of the scarlet-breasted robin is black.

These robins generally make their appearance about the end of March or beginning of April, and, as Mr. A. J. Campbell says—" On the approach of spring, September, they all disappear as mysteriously as they arrive. They, no doubt, go to their breeding haunts, which would seem to be chiefly Tasmania and the intermediate islands. A few remain on the mainland, or retire to breed on the uplands of the great Dividing Range and adjacent spurs."

The whole of our robins may be set down as strictly insect-destroying birds, and should be jealously protected by growers and others.

SELECTING THE LOCALITY FOR AN APIARY.

By R. Beuhne.

Owing to the prevalence of diseases, the low price of honey, and the absence of a profitable outside market, bee-keeping in Victoria has become so intricate a business that it can no longer be carried on as a side issue in connexion with other rural pursuits. Since the removal of the border duties it is more important than ever to produce only honey of the best quality, and those who intend to devote themselves to the highly interesting and fascinating pursuit of apiculture should bear in mind that the quality of the product will depend entirely on the locality selected for the apiary, provided, of course, that approved modern methods are followed in taking and marketing the honey.

Many, who commenced bee-keeping in past years, knew no other quality of honey than that of the locality they happened to live in or were acquainted with, and, after spending money and time in the establishment of an apiary and a home, found that the quality of their product was such that bee-keeping could not be carried on profitably, for, although the yields were fair, the value of the honey was only one-half to two-thirds of that from more favoured districts.

Roughly speaking, the country north of the Dividing Range produces a lighter-coloured, denser, and milder honey than the southern districts. There are, however, some noteworthy exceptions, which will be referred to later. The lighter the average rainfall of a district the paler and clearer the honey, thus the country in the far west of Victoria produces some of the finest, while the heavily-timbered country of Gippsland and the East yields a dark and strongly-flavoured product. It must not be understood that it is the rainfall which causes the inferior quality. Far from it; for even in the driest districts a good rainfall improves the quality and increases the quantity of honey, and some almost equal to English is produced in parts of South Gippsland; but it so happens that the eucalypts growing in wet districts produce a strong, dark honey, and those in dry country a milder and paler one. Stringy-bark, messmate, peppermint, &c., are included in the former, and redgum, yellow and grey box, ironbark, and mallee scrub in the latter. The dividing line between the two classes is a rainfall of 25 to 30 inches, and country where they intermingle produces sometimes a blend of the two qualities of honey, and at other times either the one or the other, according to which variety of eucalypt blooms or secretes nectar most in a particular season. In much of this intermediate country there is an undergrowth of flowering scrub, principally various Mimosæ, blooming in spring, and what little honey is gathered from these, being stored first in the combs, slightly affects the quality of all that stored subsequently. The Mimosæ, however, produce pollen in abundance, and are, therefore, valuable for building up colonies to the maximum strength, so that the slight deterioration of the quality is, perhaps, amply compensated for by the increased quantity of honey resulting from the greater force of field bees, due to a plentiful supply of pollen.

In the drier districts where no undergrowth exists there is usually some difficulty in developing really strong colonies, but the quality of honey is very superior. Some apiarists have during the past season overcome the difficulty of shortness of pollen by extensive sowings of rape or mustard at such a time as to have the bloom early in spring, the commercial value of the seed gathered later on defraying the cost.

Country with a rainfall of over 35 inches annually should be avoided in selecting a locality for bee-keeping as a business. It is to be hoped that a method of refining the honey produced in such districts may be discovered, so that the immense resources of Gippsland and the coastal country may be turned to profitable account.

The honey of the best quality, referred to before, as gathered in some parts of South Gippsland, is obtained from white clover and thistles, and the country producing it is limited in extent. Although clover thrives well in many other localities, it does, strange to say, only occasionally secrete nectar ; it is only for a short distance inland from the sea coast that it is at all reliable.

In selecting a locality for an apiary it will therefore be best to choose country where redgum, yellow box, and grey box predominate, bearing in mind that the distance from which bees can profitably gather nectar is about 3 miles, and that a locality with only one of the above trees within reach of the bees is liable to a failure every alternate year. I have no hesitation in setting down locality as the first and most important condition to success in apiculture.

BITTER PIT AND CRINKLE OF THE APPLE.*

By D. McAlpine.

In the Annual Report published last month reference was made to the experiments carried out during the past season to determine the effect of manurial treatment on these two closely allied diseases of the apple. Though the results had been available for some time it was found impossible to give the necessary time to their consideration till just recently.

The experiments were conducted in Mr. Christie's young orchard at Nyora, in South Gippsland, and the varieties chosen were particularly susceptible to these two diseases. For the Crinkle tests there were 22 plots each consisting of two trees of Five Crown and two of Rome Beauty, and the same number of plots of two trees each of Scarlet Nonpareil for the Bitter Pit. Unfortunately, the Black Spot was so severe upon the latter variety that no data were obtainable to enlighten us as to the conditions favorable or the reverse to the development of the Bitter Pit.

The Crinkle Experiments.

As the Five Crown and the Rome Beauty were not appreciably affected by Black Spot, some material facts were obtained as regards the Crinkle. At the same time it is not safe to draw any absolute hard and fast conclusions from the results of one year's work, such experiments always require to extend over several seasons.

The manure applied to each tree is shown below. Each pound per tree may be taken as representing approximately 1 cwt. per acre.

Plot 1. Sulphate of Ammonia, 2lbs. 8oz.
Concentrated Superphosphate, 1lb. 3oz.
Potash Chloride, 11 oz.
Plot 3. Same as 1, but no Sulphate of Ammonia.
5. ,, ,, Superphosphate.
7. ,, ,, Potash Chloride.
9. Common Salt, 3 lbs.
11. Same as 1, with 3 lbs. Salt.
13. Sulphate of Iron, 1 lb.
15. Same as 1, with 1 lb. Sulphate of Iron.
17. Same as 1, with 20 lbs. Lime.
19. Salt 3 lbs., Lime 20 lbs.
21. Lime 20 lbs.
2, 4, 6, 8, 10, 12, 14, 16, 18, 20, and 22 checks—Not manured.

The lime was applied in August, and about three weeks previous to the application of the manures containing ammonia.

The healthy and the diseased fruits from each tree in each plot were counted and weighed separately. This exhaustive system was adopted so as to be able to view the results in several different ways, and to serve as a check upon possibly erroneous deductions, but in the following

* NOTE.—A description of these diseases may be found in Guide to Growers, No. 48.

table only the total weights and percentages in each plot from each variety are given.

TABLE I.—SHOWING EFFECT OF MANURES UPON CRINKLE.

(Plots arranged in order of prevalence of disease in the Five Crowns.)

Plot.	Manure.	Five Crown.			Rome Beauty.		
		Clean.	Crinkled.	Crinkled.	Clean.	Crinkled.	Crinkled.
		lbs.	lbs.	per cent.	lbs.	lbs.	per cent.
1	Complete manure ...	15	33	68	78½	15	16
7	,, ,, less K...	16	11	40	18½	¼	1½
15	,, ,, + Fe...	10½	7½	40	2½	¼	9
5	,, ,, less P...	36	23	39	17	2½	15
11	,, ,, + Salt	13	8	38	12½	2½	17
12	Check	24	13	37	1	0	0
20	,, ...	17½	12½	31	7	1½	17½
8	,, ...	21½	9½	30	21	1½	2
4	,, ...	15	6	28	6	2½	29
13	Sulphate of Iron ...	27	10	27	6	0	0
19	Salt and Lime	31	11	26	2	0	0
2	Check	30½	11	26	11½	3	20
3	Complete manure less N	28	9½	25	29	10	25
6	Check	26½	8½	25	7	1½	17½
17	Complete manure + Lime	19½	6½	25	1½	0	0
9	Salt	15	4½	23	2	0	0
21	Lime	32	8	20	½	0	0
18	Check	25	5½	18	8	½	6
22	,, ...	87	19	18	1½	½	25
10	,, ...	32½	6	15	3	C	0
16	,, ...	4	½	12	1½	0	0
14	,, ...	9	1	10	9	½	5
	Average of Checks ...	...	...	**23½**	...	...	**12**

NOTE.—K. (Potash) may be taken to mean Potash Chloride.
N. (Nitrogen) ,, ,, Sulphate of Ammonia.
P. (Phosphoric Acid) ,, ,, Concentrated Superphosphate.
Fe. (Iron) ,, ,, Sulphate of Iron.

Criticism of the Results.—With regard to the Five Crowns, taking all the checks, the average percentage affected by Crinkle was 23½, the highest, 36%, being in Plot 8, and the lowest, 10%, in Plot 13. The five worst plots in the list—Nos. 1, 7, 15, 5, and 11– all received Nitrogen, and No. 1, receiving a medium dressing of complete manure, had by far the most affected, with 68% diseased. Bearing this in mind, and comparing Plots 1 and 3 with and without nitrogen, 68% and 25% respectively, it may be taken as certain that nitrogenous manures will increase the disease. The results from Plots 1, 3, 5, and 7 would appear to indicate that Potash might prove valuable in reducing the disease. Lime alone was a shade better than the average of the checks, and though Salt alone was about the same as the average check, the two combined were considerably worse.

Treating all the checks as one, the following table shows the relation between the manures and the disease in a more convenient form.

TABLE 2.—ABSTRACT OF RESULTS.

Five Crown.		Rome Beauty.	
Manure.	Per cent. Crinkled.	Manure.	Per cent. Crinkled.
Complete Manure ...	68	Complete Manure, less N. ...	25
,, ,, less K. ...	40	,, ,, + Salt ...	17
,, ,, + Fe. ...	40	,, ,, ...	16
,, ,, less P. ...	39	,, ,, less P. ...	15
,, ,, + Salt ...	38	Average of Checks ...	12
Sulphate of Iron ...	27	Complete Manure, + Fe. ...	9
Salt and Lime ...	26	,, ,, less K. ...	$1\frac{1}{2}$
Complete Manure, less N. ...	25		
,, ,, + Lime ...	25		
Average of Checks ...	$23\frac{1}{2}$		
Salt ...	23		
Lime ...	20		

Turning to the results with the Rome Beauty, it may first be remarked that on the whole they were remarkably free from the disease, and there was scarcely an apple not fit for market, a very different state of affairs from that existing in the Five Crowns. The crops also, on the average, were very light so that in nearly half the Plots no deductions can be drawn. The average affected, taking all the checks together, was 12°/ₒ—a figure exceeded by the four manured Plots 3, 11, 1, and 5, though the best return—$1\frac{1}{2}$°/ₒ—was from a complete manure without Potash. Here, however, there was only one tree, and it was noted in other plots that one tree might have from 5 to 10°/ₒ and the other from 25 to 30°/ₒ affected. As only two plots gave a fair yield, No. 1, complete manure, with 16°/ₒ affected, and No. 3, complete manure without Nitrogen, 25°/ₒ, these are the only two in which comparisons can be made with the average of the checks, though here the suggestion is rather that Nitrogen was required by the Rome Beauty, which is diametrically opposed to the results with the Five Crown. It may be that the difference of the varieties has something to do with this, though it is just as likely that the results would be reversed in another year.

General Summary.—Viewed as a whole, the results are mainly negative. If they show anything at all, it is that the stimulating effect of the manure, at least in a moist spring and in young trees, has a decidedly injurious effect on the fruit. This is quite in keeping with the established fact that fruit from young and vigorous trees does not keep so well as that from more mature specimens. There is just a possibility of mitigating the Crinkle, and perhaps, too, the Bitter Pit, as both these diseases are due to what may be termed disordered nutrition, by the use of a Potash manure alone or in combination with lime or gypsum, and these will be tried in the coming season.

TAKE-ALL IN WHEAT.

By D. McAlpine.

Experimental Work.

Three sets of experimental plots to test the various methods suggested for preventing Take-All were projected for this season, but owing to the abnormally dry weather the arrangements were seriously interfered with. One set was to be at Quambatook, another near Horsham, and the third at Sheep Hills. In all three cases the land selected was badly affected with the disease last season, and half was to be sown on dry ploughed and the other half on wet ploughed land. Only at Sheep Hills were the conditions favorable to doing all the sowing on the same day, the ploughing, both wet and dry, having been done previous to the visit of my assistant to supervise the sowing. At Horsham the dry sowing was done early in May, and the land rolled immediately, but the wet half had to be left over till rain fell.

General Considerations.—Recent inquiries certainly tend to strengthen the belief expressed in the first number of the *Journal* that the Take-All patches are generally associated with want of moisture in the early stages of the growth of the wheat plant. This is one result of excessive looseness of the soil, to some extent a natural feature, but aggravated by late fallowing and working the land when dry. Occasionally crops on soil with a tendency to set like a brick—too solid in fact—will exhibit the same symptoms. In some districts, too, there are considerable stretches of land on which wheat never gives a satisfactory yield, at least without manure, notably a kind of hard red sandy loam in the Wimmera, often overrun with daisies. Strictly speaking, the failure of the crops in the last class of land cannot be said to be due to Take-All. Some observant farmers often speak of a minute insect or worm on the roots, which I have reason to believe is identical with the Thread Worms or Nematodes found in nearly every sample of affected wheat sent for examination last season. It may well prove that these are a contributory cause, and careful inquiries will be made this spring to clear up this point.

South Australian Experiences.

To date 58 branches of the South Australian Agricultural Bureau have forwarded replies to the circular of questions given in the first number of the *Journal* and kindly sent out by Mr. Molineux, the General Secretary. Nine of these however had to be discarded since they contained the acknowledgment that little or nothing was known of the disease in their districts.

Class of Land affected.—Of the 49 replies remaining to be considered, no fewer than 41 were strongly of opinion that the disease was largely confined to the very loose soils. Of these, 21 from crab-holey country were unanimous on this point, though eighteen classed the loose banks

as worse as against three for the loose hollows. On the level lands twenty agreed that the crops in loose soils were much more seriously affected, while only four were of opinion firm lands were more liable.

The following table shows the nature of the replies under this head:—

Loose land ...	Loose level land	20	41
	,, hollows in crab-holey land ...	3	
	,, banks ,, ,, ...	18	
Heavy firm land			3
Low-lying clay flats			1
Firm sandy land			1
Opinions evenly divided			3
	Total		49
	Rejected		9
	Gross Total ...		58

Suggested Preventive Measures.—Little fresh light is cast upon the problem by the other answers since they are so contradictory. Opinions are about evenly divided as to whether rolling or manuring with superphosphate have any appreciable preventive effect, though one farmer reports considerable success with applications of sulphate of ammonia to the patches. Where suggestions for treatment were given they are practically the same as were suggested in the first issue of the *Journal*. The trouble appears to lie mainly in the mechanical condition of the soil, and this may as a rule be improved by early fallow, working the land only when wet, feeding off the crop with sheep where sufficient growth takes place, and rolling after sowing. Some farmers strongly advise rolling the fallow where the soil is inclined to looseness, and this would probably be found of some value.

In many districts the annual losses from Take-All are severe, but there is every reason to believe that as agricultural methods improve, and the keeping of sheep and cattle becomes a more general feature of our farming, less will be heard of the trouble. Apart from the many indirect benefits of diversified farming, the consolidation of soils and their general improvement is more satisfactorily accomplished by stocking than by any other means. But before it becomes profitable or possible to do this in our dry northern districts some drought-resisting grass or fodder plant suitable for the conditions prevailing there will need to be introduced. Over great stretches in the north the paddocks are overrun with wild oats, daisies, wild poppies, hedge mustard, barley grass, and other weeds with a low feeding value, or none at all, and in some parts hardly a single specimen of any grass worthy of the name is to be found.

FIG 1.—EGGS PACKED FOR EXPORT.

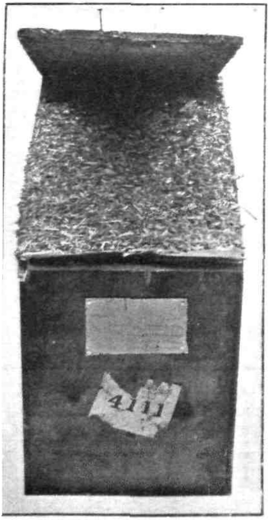

FIG. 2.
EGGS SUITABLY PACKED FOR TRANSIT TO MARKET.

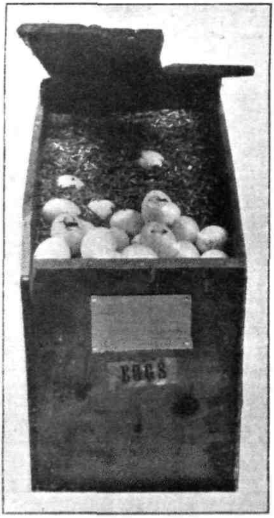

FIG. 3.
CONDITION OF BADLY PACKED EGGS ON ARRIVAL FROM THE COUNTRY

PACKING AND STORING EGGS.

By A. Hart.

Packing Eggs for the Local Market.

Several improvements are urgently required in the methods usually employed in the packing of eggs intended for sale in the local market. The best prices can never be realized from any article unless put up in an attractive manner, a statement which applies with particular force to perishable products, which are so liable to become tainted. Dirty eggs should never be sent to market; but eggs collected from clean nests, and sent in for sale with the bloom on, are always better in appearance than those which have been washed. In the past such objectionable material as green sawdust and musty or dirty chaff has been considered by many as quite good enough for packing purposes. When such substances are used, in combination with weak, dirty, and unsuitable boxes, it is little wonder that prices often prove unsatisfactory. With the object of effecting improvements in this direction, the Department has exhibited at various country shows a specially suitable box, and demonstrations in packing eggs have also been given.

The box is similar in size to the ordinary kerosene case, and is both cheap and effective. In packing, a layer of clean hay or straw is placed upon the bottom, and then a layer of eggs, which is covered with sweet dry chaff, and a sheet of paper placed over all. The layers are continued in this manner till the box is full, sufficient space being allowed to remain at the top for a covering of hay or straw. By adopting this method all jarring is prevented, and the loss in breakages is practically *nil*.

Cold Storage for Eggs.

As a result of the practical demonstrations afforded by the Department that eggs can be kept in first-class condition for a lengthened period by means of cold storage, it is satisfactory to note the farmers and storekeepers are now taking advantage of this system. Last season 86,251 dozen eggs were placed in the Government ool store, their value at the time being only 8d. per dozen; and these were afterwards placed on the market when new laid eggs were scarce and dear, and realized the satisfactory price of 1s. 4d. per dozen.

This shows a very substantial margin of profit in storing eggs, since the cost is only 1½d. per week for a box of 2 cubic feet, containing 25 dozen, so that the total cost of storing for six months is less than 2d. per dozen. Gain will result not only from the actual profit on the eggs stored, but also through the beneficial effect exerted by the withdrawals from the market in periods of plenty, which will tend to prevent a glut, and in this way prices will be regulated to an appreciable extent and consumers enabled to secure fresh eggs all the year round.

The proper time to place eggs in store is when they are cheapest, that is in the spring months—September, October, and November. The utmost care should be exercised so that only perfectly sound fresh eggs are packed, and the grading for size and colour is best done as for the export trade. With the beginning of autumn, prices begin to rise steadily, and generally reach their highest level in May, June, and July. When individual farmers engage in this business of storing, they will find it necessary to exercise good judgment in determining the time when the eggs should be withdrawn for sale. In this, as in other speculations, it is a good rule to sell part, at least, as soon as a good profit is shown; the novice as a rule is inclined to overstay the market, with unsatisfactory results.

The possibilities of increased returns in this way, especially if considered along with the splendid opening for eggs and birds in the British market, should offer sufficient inducement for considerable expansion in the poultry industry in this State. Though the business must be regarded as only in its infancy at present, signs are not wanting that those already engaged in it are fully alive to the situation, and a large extension of operations may be looked for in the early future.

GENERAL NOTES.

Mangels for Winter Feed.

Of all the root crops grown for winter feed for dairy cattle, perhaps none are so satisfactory or so profitable as the mangel, where soil and climate are suitable. A few farmers in the cooler parts of the State have been in the habit of growing a small area every year, but the practice is not so general as it should be. When fed to cows at the rate of 25 to 30 lbs. per head per day, together with as much good oat straw as can be eaten, the supply of milk during the winter months is maintained at a high level. Mr. Wm. Goldie, of Port Fairy, has grown mangels for many years, and he states that the average yield with him is not less than 60 tons per acre, and though in bad seasons only 45 tons may be obtained, in favorable years up to 80 tons is not uncommon.

The first essential for success in mangel culture, in Mr. Goldie's opinion, is a piece of good soil in a moist, but not wet situation, as the roots have to grow in the summer. The land is ploughed in May which soon brings up the weeds, and early in September a good scarifying is given, and sufficient harrowing to reduce the soil to a fine tilth. Raised drills about 28 inches apart are made with the hiller, and then the surface is flattened and compressed with the roller.

The quantity of seed required when sown by hand, as in Mr. Goldie's practice, is about 3 lbs. per acre. A dibble 16 inches long is used, and with this a small hole is made about half-an-inch deep, into which two or three seeds are dropped, and the earth firmly pressed over them. The distance between the holes is 16 inches, which is measured by the dibble of that length. Hand sowing may seem a slow and tedious method, but when over 100 tons of roots can be obtained from a couple of acres, the labour cost is comparatively trifling. On large areas the drill might be used with advantage.

When the plants have been up a few weeks and are abou. 5 inches high, they are thinned out so as to have a single plant every 16 inches. The hand hoe is used to clean between the plants when young, and the horse hoe is worked between the rows, which besides removing the weeds, tends to level down the raised drills. Two or three workings are generally all that is required.

The roots are pulled in May, and when the Yellow Globe variety is grown, they are easily lifted by hand, since the cultivation practically obliterates the raised drills on which the seed was sown, the roots being left almost resting on the surface. The tops are pulled off and the roots carted to a convenient spot, where they are piled in heaps about 6 feet high. No cover is required, and Mr. Goldie believes that after being stacked for a few weeks they are better for

feeding purposes, becoming a little softer, and so more easily eaten by stock. Feeding with mangels generally commences in June, and is continued till September.

A liberal supply of plant food is necessary to grow good mangels as they are such gross feeders. A dressing of 1 cwt. of concentrated superphosphate, 1 cwt. of nitrate of soda, and 1 cwt. of salt, has been found the best for the conditions existing on Mr. Goldie's farm, and it is applied just before sowing.

Feeding Calves.

In a paper read before the last Dairymen's Conference by Mr. J. R. Weir, the Chief Inspector of Stock, attention is called to the necessity *of exercising more care in the feeding of calves. To prevent the heavy* losses occurring every year, the calves should be fed regularly with food at an even temperature, and scrupulous cleanliness practised in every detail. A common mistake is to feed too many together, whereas each should be fed alone, which may easily be done by dividing the shed into stalls with the troughs at the end. The amount of food given to each can thus be regulated, and over-eating prevented.

Separated milk which contains little fatty matter may be made more suitable for young calves by the addition of a small amount of linseed meal. Hay tea also is a good food and especially valuable when milk is scarce.

White scour is responsible for the death of many calves. Professor Nocard recently completed a lengthened investigation into the cause, and proved that infection takes place by way of the navel, and not by the feed as was formerly thought. Hence the advisability of killing all calves so affected, and a thorough disinfection of the place where the sick beasts are found. The weakening effect of white scour is so great that even if the calves recover they generally succumb later to lung complaints.

Some Heavy Sheep.

Some remarkably heavy carcasses of Border Leicester ewes were recently on view in the shop of Messrs. Angliss and Co., of Bourke-street, Melbourne. The sheep were bred by Messrs. Willis and Co., of Stony Creek, and realized at auction the highly remunerative figure of 43s. per head. One of the dressed carcasses turned the scale at 190 lbs.; another at 182; and the lowest weight was 120 lbs. It is very doubtful whether heavier sheep have ever been sold in the Melbourne market.

A Potato Crop Competition.

An interesting competition for the best crop of potatoes was promoted last season by the West Bourke Agricultural and the Lancefield Farm and Garden Societies, particulars of which have been received from Mr. John Rogerson, the secretary of the first-named body. The

conditions stipulated that the plots were not to be less than 10 acres in extent, and half an acre of the average crop was to be dug and weighed, the quality as well as the amount of the produce to be considered in the judging.

Mr. A. Vinnicombe, of Romsey, secured the first place with a yield of 3 tons 8 cwt. 1 qr. 18 lbs. on the average half-acre, the second prize being awarded to Mr. R. A. Colliver, of Lancefield, who obtained 3 tons 8 cwt. 1 qr. 13 lbs. from his half-acre.

In preparing the land for the first prize crop a 3-inch ploughing was given the first week in May, one of 8 inches at the end of July, and a third also of 8 inches in the first week in October. Then the ground was scarified once, harrowed four times and rolled three times. An application of 4 cwts. per acre of Cuming Smith's Potato Manure was made. The round sets which were used were ploughed in during the third week in October, at a depth of 4 inches, the distance between them being 20 to 23 inches, and the width between the rows 27 inches. After the crop came up it was horse-hoed once, and the weeds pulled by hand. The last four crops on the land have been potatoes, barley, peas, with barley the year before the competition.

The land on which the second prize was grown received two ploughings, the first of 6 inches late in February, and the other or 8 inches in the middle of September, and afterwards was scarified twice, harrowed twice, and rolled once. A dressing of 3 cwt. per acre of gypsum was drilled in on 28th and 30th September. The seed used was round sets, which were ploughed in at a depth of 4 to 5 inches, 22 to 24 inches apart, with 28 inches between the rows. Hand-hoeing was given to the growing crop. On Mr. Colliver's farm the four-course rotation, barley, peas, hay and potatoes, is always practised.

Victorian Apples.

A consignment of specially selected apples sent over by the Victorian Government Department of Agriculture has been exhibited by Mr. J. B. Thomas in the Floral Hall, Covent Garden, London, this week. 100 cases in all were sent per the *Oroya*. The condition of the fruit is not quite up to the best Victorian mark, but it must not be forgotten that the season is far advanced. The fruit is as g. od as can be expected at this time of the year. The Victorian senders have shown by their consignments this year that their fruit stands in the forefront of Australasian supplies, and the selected fruits from this colony have realized the best prices throughout the season.

Although this consignment is sent with the main view of showing the special quality of the fruit produced in the Victorian orchard, we consider that Mr. J. B. Thomas has handled this season better consignments from private senders.

We will deal with the individual varieties comprised in the consignment in our next issue, but we may say that the pick in our view are "Rome Beauty," "Statesman," and "Scarlet Nonpareil."

—*Fruiterer*, London.

The Measurement of Dams.

A simple method of ascertaining the contents of a dam is often desired. The sloping sides and ends are the cause of the trouble that farmers experience in their calculations. The following rule and example will be found to meet requirements:—

Add together the area of the top, the area of the bottom, and four times the area of a section half-way down, multiply the total by the depth, and divide the result by 6.

The basis of the measurements must of course be the same throughout, yards or feet, as the case may be.

Suppose we wish to know the number of cubic yards in a dam 30 yards long by 10 yards wide at the top, and 20 yards long by 8 yards wide at the bottom, with a depth of 3 yards.

First to find the areas :—

Length 30 × width 10 = 300 sq. yds., the area of top.
,, 20 × ,, 8 = 160 sq. yds., the area of bottom.
(30 + 20) ÷ 2 = 25, the middle length.
(10 + 8) ÷ 2 = 9, the middle breadth.
25 × 9 × 4 = 900 sq. yds., that is 4 times area of section half-way down.

Total of areas 1,360 sq. yds.

Then, $\frac{1,360 \text{ (sum of areas)} \times 3 \text{ (depth)}}{6} = 680$, the number of cubic yards in the dam.

If the measurements are in feet, and it is desired to have the contents in cubic yards, then divide the result by 27.

Resin Wash.

Mr. Jas. Lang, of Harcourt, gives the following method of making this valuable insecticide :—

Resin	20 lbs.
Caustic soda, 98 per cent. ...	3 lbs.
Neatsfoot oil	2 pints.
Water	80 gals.

Place the resin, soda, and oil in a large vessel with 20 gallons of water and boil for three hours, then add *hot* water slowly to make up to 40 gallons, stirring well in the meantime. Cold water may be added afterwards to make up to 80 gallons. In the process of cooking, cold water should never be added, as it will cause the precipitation of the resin, which will be difficult to dissolve again.

For summer use take 1 part of solution and add 2 parts of water. This insecticide is specially valuable for Red Spider and Mussel Scale.

A Method of Grafting.

At the annual meeting of the Ontario Fruit-growers' Association last year one of the speakers said that the old system of grafting was to put two scions in, one in each side of the branch. One has afterwards to be cut off, leaving a short edge that is a source of annoyance

for years in throwing suckers. As the result of previous experiments the plan now generally adopted by him was to cut the limb on a bevel and square off the sharp corner a little, and then to insert one scion on the upper edge. When the scion begins to grow the cut will commence to heal and no suckers will be pushed out as in the old plan. In two years it is scarcely possible to notice that the limb has been grafted. With this system it is better to choose smaller branches, and as every good grafter should make nineteen grow out of twenty, the saving in labour is considerable.

RAINFALL IN VICTORIA.

Month of June, 1902.

By P. Baracchi.

Areas.	Actual Average Rainfall recorded in each Area in June, 1902.	Average Rainfall for each Area for the Month of June, based on all previous Years of Record.	Maximum Fall recorded within each Area during June, 1902.
	inches.	inches.	inches.
A	1·09	1·71	1·42 at Rainbow
B	2·02	2·43	3·35 " Apsley
C	3·27	3·44	4·08 " Hamilton
D	3·90	4·31	5·61 " Port Campbell
E	1·24	1·98	1·67 " Echuca
F	2·60	2·83	3·54 " Chiltern
F[1]	2·65	3·23	3·29 " Murchison
F[2]	5·26	4·97	6·24 " Yackandandah
G	2·16	2·93	3·21 " Kyneton
H	3·26	3·77	4·56 " Daylesford
I	2·43	2·62	3·85 " Ballan
I[1]	3·02	3·53	4·36 " Lilydale
K	4·90	5·72	8·48 " Wood's Point
L	3·81	3·37	5·42 " Bruthen
M	1·13	4·54	1·13 " Gabo

Month of July, 1902.

Areas.	Actual Average Rainfall recorded in each Area in July, 1902.	Average Rainfall for each Area for the Month of July, based on all previous years of record.	Maximum Fall recorded within each Area during July, 1902.
	Inches.	Inches.	Inches.
A	0·21	1·25	0·39 at Hopetoun
B	0·68	2·01	1·49 " Apsley
C	1·62	3·12	2·81 " Koroit
D	2·35	4·00	3·51 " Cape Otway
E	0·27	1·34	0·40 " Kow Swamp
F	0·49	2·19	0·71 " Shepparton
F[1]	0·94	2·54	1·16 " Nagambie
F[2]	0·75	4·04	0·86 " Tallangatta
G	0·83	2·19	1·56 " Maldon
H	1·24	3·02	1·47 " Daylesford
I	0·65	2·36	0·88 " Ballan & Yan Yean
I[1]	1·09	3·48	1·57 " Lilydale
K	1·93	4·40	3·47 " Wilson's Promontory
L	2·33	2·62	3·56 " Bairnsdale
M	...	3·61	

TABLE SHOWING RAINFALL over the 26 basins or regions constituting the State of Victoria, recorded in the second quarter of the year 1902, together with corresponding averages deduced from all the records of past years.

Name of Basin.	2nd Quarter.							
	April.		May.		June.		Total for 2nd Quarter.	Average for 2nd Quarter.
	Amount, 1902.	Average.	Amount, 1902.	Average.	Amount, 1902.	Average.		
Glenelg and Wannon Rivers ...	0·28	2·39	1·12	2·72	3·81	3·57	5·21	8·68
Fitzroy, Eumerella, and Merrie Rivers	0·63	2·45	1·29	3·09	3·87	4·09	5·79	9·63
Hopkins River and Mount Emu Creek	0·36	2·48	1·19	2·48	3·27	3·12	4·82	8.08
Mount Elephant and Lake Corangamite	0·13	2·38	0·89	2·25	2·50	2·74	3·52	7·37
Otway Forest	0·67	3·75	1·65	3·87	4·75	4·94	7·07	12·56
Moorabool and Barwon Rivers ..	0·20	2·48	0·71	2·42	2·70	2·86	3·61	7·76
Werribee and Saltwater Rivers ...	0·53	2·48	0·66	2·42	2·98	2·80	4·17	7·70
Yarra River and Dandenong Creek ...	1·13	3·05	1·92	3·09	3·53	3·51	6·58	9·65
Koo-wee-rup Swamp	1·14	3·13	1·73	3·31	3·26	4·12	6·13	10·56
South Gippsland	1·25	3·48	1·69	3·33	3·64	5·02	6·58	11·83
La Trobe and Thomson Rivers ...	1·15	3·21	1·62	2·84	3·82	4·06	6·59	10·11
Macallister and Avon Rivers ...	0·54	2·36	0·24	1·90	3·33	2·42	4·11	6·68
Mitchell River	0·68	2·71	0·28	2·17	5·03	3·00	5·99	7·88
Tambo and Nicholson Rivers ...	1·11	2·67	0·36	1·72	4·40	3·36	5·87	7·75
Snowy River	1·88	3·27	0·59	2·29	4·74	4·32	7·21	9·88
Murray River	0·03	2·10	0·08	2·46	2·59	3·09	2·70	7·65
Mitta Mitta and Kiewa Rivers ...	0·20	2·57	0·08	3·63	5·82	4·99	6·10	11·19
Ovens River	0·05	2·85	0·21	4·15	5·18	6·33	5·44	13·33
Goulburn River	0·05	2·24	0·25	2·92	3·10	3·42	3·40	8·58
Campaspe River	0·19	2·24	0·31	2·87	2·83	3·25	3·33	8·36
Loddon River	0·10	1·97	0·25	2·15	1·80	2·42	2·15	6·54
Avon and Richardson Rivers ...	0·03	1·71	0·24	1·79	1·50	1·98	1·77	5·48
Avoca River	0·14	2·01	0·22	2·05	1·69	2·40	2·05	6·46
Eastern Wimmera	0·05	1·99	0·77	2·06	2·56	2·81	3·38	6·86
Western Wimmera	0·02	2·13	0·58	2·45	2·52	3·26	3·12	7·84
Mallee Country	0·10	1·71	0·31	1·53	1·33	1·95	1·74	5·19
State	0·49	2·53	0·74	2·61	3·32	3·46	4·55	8·60
Weighted averages	0·39	2·35	0·63	2·43	3·01	3·21	4·03	7·99

STATISTICS.

PARTICULARS OF FROZEN PRODUCE exported from Victoria from 20th June, 1902, to 31st July, 1902.

Description of Produce.		Shipped through Government Cool Stores.	Shipped through other Cool Stores.	Total Quantity Shipped.
Butter (Victorian)	lbs.	104,664	493,770	905,818
,, Tinned (ex Bond and Inter-State)	"	307,384		
Milk and Cream (Concentrated) ...	cases	938	162	1,100
Cheese	lbs.	...	12,528	12,528
Eggs	dozen	2,168	...	2,168
Rabbits	pairs	208,862	92,556	301,418
Hares	"	224	...	224
Poultry	head	13,871	150	14,021
" ex Bond	crates	375	610	985
Lamb and Mutton	carcasses	72	8,789	8,861
Calves and Pork	"	156	25	181
Veal	sides	...	50	50
Beef	qrts.	80	...	80
Fruit	cases	275	878	1,153
Sundries	lbs.	11,973	24,087	36,060

R. CROWE,
Dairy Expert.

Export of Fruit.

RETURN showing Number of Cases of Fruit and Plants Inspected for Export to Australian States and New Zealand only, from 21st June to 31st July, 1902.

Name of Fruit, &c.	Cases Inspected.	Certificates Issued.
Apples	354	56
Bananas	3,326	491
Lemons	1,381	190
Oranges	1,864	237
Passion Fruit	83	47
Pears	9	1
Persimmons	2	2
Pineapples	129	89
Plants	237	144
Total	7,385	1,257

RETURN of Fruit Inspected for Export to Ports beyond the Australian Commonwealth, from 21st June, to 31st July, 1902.

Colombo ... ... Apple ... ... 2 cases

J. G. TURNER, Inspector.

SUMMARY.

RETURN of Farm Products Exported and Certified to from 21st June to 31st July, 1902.

Shipped to.	Number.	Products.	Approx. Weight.		
			Tons	cwt.	qrs.
South Africa ...	10,614 bags ...	Potatoes	885	0	0
,, ...	900 cases ...	,, ...	33	0	0
,, ...	522 bags ...	Onions	35	0	0
,, ...	106 bales ...	Hay	5	0	0
,, ...	,657 bags ...	Oats	18,732 bushels		
			Tons	cwt.	qrs.
,, ...	65 bales ...	Chaff	10	0	0
New South Wales ...	2,693 bags ...	Potatoes	224	0	0
,, ...	3,478 ,, ...	Onions	232	0	0
,, ...	20,510 bales ...	Hay	915	0	0
,, ...	6,391 bags ...	Chaff	230	0	0
,, ...	8 ,, ...	Carrots	0	10	0
Queensland ...	1,519 bags ...	Potatoes	126	0	0
,, ...	1,469 ,, ...	Onions	98	0	0
,, ...	96 ,, ...	Maize	9	0	0
West Australia ...	5,959 bags ...	Potatoes	496	0	0
,, ...	501 ,, ...	Onions	33	0	0
,, ...	319 ,, ...	Oats	1,280 bushels		
,, ...	5 ,, ...	Wheat	21 ,,		

J. KNIGHT.

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